

The Tesla Genius:

Part 1: Cultured sculptor of the electric world
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The principal mark of genius is not perfection but originality,
the opening of new frontiers — Arthur Koestler

Recently, I examined an American history book (Norton et al 1986, 481) for any references to Nikola Tesla. I found a half-dozen or more references to Thomas Alva Edison, two for George Westinghouse, and great quantities of text given over to J.P. Morgan. Not only was Tesla not mentioned, but Morgan, Edison, and especially Westinghouse were all incorrectly cited for the results of Tesla's work. Why is it that Tesla is consistently not credited for his original work? Why is it that he is sometimes credited with works that he wasn't directly involved with?

There are very few figures in recent American history that have inspired more awe, fascination, cult heroism, and respect than Nikola Tesla (1856–1943). His contemporaries were divided sharply over him. Edison criticized him; Westinghouse hailed him; Johnson and O'Neill worshipped him, Crookes and Scherff respected his true genius. He was showered with many honors and awards, and given numerous honorary doctorates from universities all over the world. Tesla was a member of the New York "400," and considered a prize catch by high society. Mark Twain was numbered among his closest friends. Where did this man come from? What did he do to earn such notoriety? Why were people polarized into such extreme opinions about this enigmatic engineer from Croatia (now Yugoslavia). A proper analysis that would answer these questions of the life of this man could quite well take a historian of science and technology a significant part of his career to work out in detail.

I propose to provide for the reader an introductory three-part survey of Tesla's life and accomplishments. In this first part, a biographical survey of Tesla's life is presented with emphasis on some of the more important people in his life, and the major events that affected his life. The second part will explore the technical accomplishments of Nikola Tesla. It will cover those things that Tesla brought to practical use, and those things that Tesla built but, due to limitations in capital funding or in the prevailing technology, wasn't able to develop a successful product. It concludes with a review of some of the hundreds of ideas, visionary technologies, and fanciful speculations that Tesla had shared with interested listeners throughout his whole life. The third and final article will develop more fully some of the questions raised in the prior articles, especially the legacy of Nikola Tesla. It will explore the mystical nature of the man, which triggered a whole industry of occult opinions about him. It will also examine the political climate that he found himself in, with special notice of the polemics that were written after his death.

To my mind the satisfactory overview of the life of Tesla can be best separated into three broad intervals. The first part of his life I call the Constructive Period. It includes his formative years in Croatia, his education, and finally his reputation-forming years in Budapest and Paris, concluding with the passage to America. The Productive Period starts from his arrival in New York, and ends approximately after the turn of the twentieth century—a period that saw the realization of great and innovative technology from the genius of Tesla's mind. The Period of Decline overlaps somewhat, the previous period. Its characteristics

include: the gradual loss of capital that Tesla desperately needed, the loss of prestige from the engineering community that once begged Tesla for his help, and finally, in his last lonely years, the loss of favor among most mainstream journalists. Unless otherwise cited, I have derived the biographical material from both the Cheney and the Hunt and Draper biographies.

Although I would like to detail Tesla's life from those books, the best that I can do in an article this brief is summarize the information, and cite references to the richer details offered in those works where possible.

Born July 10, 1856 in the village of Smiljan, Croatia, Tesla was the fourth child of five born to Reverend Milutin and Duka Mandic Tesla. The tradition of many generations of Teslas dictated a career in either the military or the ministry for Nikola. From his earliest years, Nikola's father directed him toward the ministry (Cheney [1981] 1983, 6).

The two people in Nikola's life that molded him were his mother and older brother. Particular attention should be paid to Tesla's mother. Though illiterate, she had, long before Nikola's birth, memorized Scripture, Serbian poetry, and Homeric stories of her country. For the rest of his life, Nikola had a deep love of poetry and literature. Consistent with the culture, his mother was superstitious and believed in supernatural intervention. These beliefs had a profound effect upon Tesla's personality later on. Tesla observed many of these superstitious traits especially in his later years. Yet, even though he always claimed total reliance on the rigors of science to explain everything in the universe, including the dismissal of the need for religion and superstition, he granted a place for such things in his personal life. An interesting legend has it that at the time of his birth a severe thunderstorm was in progress, and that the midwife attendant predicted that he'd be a child of the storm. I find this story highly apocryphal, but it does help serve to demonstrate that the culture of his time and place of his birth believed in omens, superstitions, and the supernatural (Hunt and Draper [1964] 1981, 17). The family was highly devoted to Nikola's older brother. Their father and other villagers couldn't believe that a family could have another son as talented and gifted as Daniel was. Again, a great deal of the drive in Nikola's later life seemed to be spent trying to prove that he was as good as Daniel. There may have been some self-guilt on Nikola's part, for he believed that he contributed to the equestrian accident that killed Daniel at age twelve (Cheney [1981] 1983, 9).

Tesla's early formative years were plagued by consistent bad luck. He managed to have every kind of accident without getting killed. The worst mishap was when, at age five, he tried flying by jumping off the barn roof with his mother's umbrella. He sustained a number of serious injuries, and his mother labored over his convalescence a long time. However, his lifelong interest in flight was merely fueled by this failure. There were early signs of genius in Nikola. At age four, he was fascinated by a water wheel turning in a creek nearby. With the help of his brother Daniel, he built a bladeless wheel that in much later years would serve as a basis for one of his most famous developments—the bladeless turbine. Despite his frequently getting into trouble in Smijan, it was for him a pastoral world, he would explore the woods and creeks, and play-out imaginary battles in the cornfields (Cheney [1981] 1983, 45).

Not long after his older brother's death, the family had to move to Gospic, allowing an urban existence that the young Tesla found confining. He continued to be a child menace with the townfolk there, but then his luck began to change following an incident with the fire station's water pump. The town turned out to see the new water pump demonstrated with seemingly all the pomp and circumstance of a Victorian coronation. On cue, the men started pumping, and what was supposed to be a great spray wasn't even a trickle. After several

repeated trials by the firemen, the observant young lad, following an instinct, jumped into the river, found and unkinked the hose. The resulting spray raised a cheer from the crowd for Tesla's feat (Hunt and Draper [1964] 1981, 20). Some mention of Tesla's physical sensory perception should also be mentioned. From an early age, his senses were extremely acute, to the extent that if one sense was "overloaded," the other senses would react too. If, for example, he heard very loud sounds, e.g., thunder, he would also perceive coincident bright flashes of light in his vision, or possibly he would also perceive strong tastes. Throughout his life, this hypersensitivity would afflict him, amuse him, or even give others cause to believe that he was a psychic (Cheney [1981] 1983, 21).

As a youth, he was well known for being able to take anything apart, and especially for not being able to put things back together—much to the occasional consternation of friends and family (Cheney 1981, 7). While others in Gospic began to recognize an inventive mind in young Nikola, his father was always quick to point out that the ministry was his only option. It should also be pointed out that Tesla himself alluded to those days—the lack of discipline in his mind, the strong impressions of lightning, clouds, birds, and his fascination with anything that produced static electricity, as those that formed the life's course that he wanted to follow.

At age fifteen, Tesla was sent to the Higher Real Gymnasium in Karlovac, Croatia, where his father intended that he study for the ministry. Living with an aunt and uncle that were living a keenly disciplined military life, Nikola finally learned the elements of discipline, fine culture, and how to starve. His aunt thought that (for whatever reasons) the young teenager's dietary intake was much too high. There is no doubt that the family could afford the food, but his aunt imposed a very restricted diet. Unfortunately, the long-term effect of this was to leave him deeply sick after contracting malaria, then subsequently, cholera. Yet the experience at Karlovac was important. For the first time, he was able to study physics in school. His professor would perform the experiments with the precision and flair of a skilled showman, dressed in formal suits for those occasions. Tesla adopted these practices in later years when he would show his own inventions in America. Tesla said much later that he felt precognitive while sitting in on those demonstrations (Hunt and Draper [1964] 1981, 21 ff).

After graduation he returned to Gospic where he contracted cholera, and he was bed-ridden for some nine months. Lethargic is the key word describing his recovery here. He had no real ambition to recover, as his father was coercing him to enter the ministry as soon as possible. During a particularly difficult stage of the recovery, Nikola was able to get his father's promise to allow him to enter engineering school, because his father greatly feared losing his remaining son. Now with purpose back in his life, Tesla strove to recover as quickly as possible. It was a highly productive time in his life when he continually dreamed of great constructions and daring technologies (Hunt and Draper [1964] 1981, 25).

Nikola Tesla entered the Polytechnic School at Gratz at nineteen. In gratitude to his father for allowing him this opportunity, he devoted himself to making the best grades possible. In an obsession to finish anything that he started, he would read the complete works of any author that was presented to him. His second year there suited him better because he took only those courses that directly contributed to his chosen career. An incident that provoked ridicule from fellow students during a physics demonstration one day eventually changed the world. A Gramme dynamo was acquired by the school, and for the day, it was the most advanced available. While observing that the commutator brushes sparked excessively, Tesla had one of his frequent, often deeply detailed flashes of insight—this time, the solution to making the dynamo work more efficiently. The insight was so complete

that he boldly asked why not make the magnetic fields rotate, rather than the windings, to eliminate the inefficient commutation of the current. According to Hunt and Draper ([1964] 1981, 29), “With Edison’s discoveries in the field of electrical distribution by direct current, such heresy was shocking and unthinkable. With Tesla’s criticism the classroom was stunned into silence by such blasphemy from a fellow student.” The reproach only served to fire Tesla’s zeal to make a practical demonstration of his idea. After graduation and his father’s subsequent death, he gained employment at the new American Telephone Company in Budapest. A strange illness struck him that was closely related to his acute senses. His nerves seemed to be frequently on fire, and he had powerful hallucinations; he would be in agony over the “loud” sound of a watch ticking three rooms away. He experienced tremors, hyperactive heart-beat rates, and he had to remain in total darkness. He heard voices that no one else heard, and could see things in the dark with perfect sense. Hunt and Draper ([1964] 1981, 32) write, “These psychic manifestations were accompanied by physical stress.” Psychics attach great significance to this episode in his life.

While at Budapest, an epiphanic vision occurred to him that was to change the world. While walking in the park reciting Goethe’s *Faust* to a friend, the answer to making an alternating—current dynamo actually work overwhelmed him. He frantically drew drawings in the dirt with a stick as he fumbled over explaining the system to his friend. Years later he was to recall that this was the most glorious of his visions (Hunt and Draper [1964] 1981, 33). But where to go next?

The next opportunity came with a transfer to the Societe Continentale Edison of France, in Paris. Tesla thrived on the old-world charm of the city. His superstitions were apparent here too; for instance, if he swam one lap in the Seine river, he would swim for twenty-seven—a number perfectly divisible by three. It was an exposure for Tesla that brought his designs and creativity to full bloom. His boss was a favorite friend of Thomas Edison. The diversity of engineers there were to his liking. Since he spoke at least eight languages, he could converse with anyone there. A new kind of life perspective fascinated him when he encountered Americans, with their entrepreneurial enthusiasm. It didn’t take long for him to become infected with the desire to go to America. In the meantime, Tesla proved his worthiness to his company by bailing them out of trouble time and time again. After some time trying to win financial support for his alternating current dynamo, including the construction of a small prototype demonstration model, he was finally able to win some support with his boss so that he could then go to America and more fully develop his ideas (Hunt and Draper [1964] 1981, 35 ff).

Arriving in America virtually penniless, he was disturbed with the urban sterility of New York city compared to Paris. Still, this was the land of opportunity, and he was able to make a quick twenty dollars repairing a motor his first day here. This greatly fueled his optimism. With a strong letter of recommendation from his boss in Paris, he sought the Edison offices a few days later. From their very first meeting, they placed a hesitant trust in each other—due to their very different backgrounds, temperaments, education, and physical statures. But at least they respected each others abilities. What is also interesting is that they had so much in common. Both could work eighteen hours a day, seven days a week, which did much to promote mutual respect. Edison was somewhat sarcastic to Tesla about his work performance, but highly praised him to others. Tesla understood English, but not the subtle nature of sarcasm. Tesla once queried Edison about his source of creative energy, and Edison replied that it was Welsh rabbit. Thereupon Tesla proceeded to include Welsh rabbit in his diet, much to his own personal disgust (Hunt and Draper [1964] 1981, 38-41).

It wasn’t long for the personal differences between the two men to begin to work against

them. Tesla began to approach Edison and others about his alternating current scheme. Edison would not hear of it. Tesla correctly regarded Edison as a man who would find a needle in a haystack by removing the stack one straw at a time. Tesla felt that there was so much time to be saved by applying a little theory and mathematics to any project that any trial and error scheme was fundamentally wasteful. The final break occurred when Edison told Tesla that if he could solve a variety of problems with the motors and dynamos, and standardize them, it would be worth \$50,000 to him. Tesla took on the project with great vigor. The results were beyond Edison's expectations, but he never had any intention of completing any financial transaction. The disillusioned Tesla left the employ of Edison without any money, and no hope of getting his alternating current system working in the near future. For about two years, Tesla suffered periods of acute depression resulting from various investors' broken promises about his alternating-current scheme tied together with his arc light. They wanted to market his arc light (which they did) while offering hope about his other projects (which they really weren't interested in). However, Tesla's reputation began to spread by word of mouth, and through one of those people, he attracted the interest of George Westinghouse (Cheney [19381] 1983, 30-35).

"Westinghouse was a daring young electrical pioneer," writes Hunt and Draper, "...with the same reckless spirit as Edison. . .he was a man of imagination but also a practical business man" (Hunt and Draper [1964] 1981, 45). Finally someone of some financial importance in the electrical industry was giving serious consideration to the commercial prospects of AC power. He had already committed his engineers to securing the rights for various AC transformer components, and needed someone like Tesla to make it work. Up to this time, there was no practical way to generate AC power, transmit it, or use it when it got to the consumer. It really looked like Edison's distribution networks of DC generators placed in every neighborhood was going to be the way that the world was to go. It took until 1888 for Tesla to finish negotiations with Westinghouse concerning patent rights and royalties. Once in Pittsburgh, Tesla immediately clashed with the existing engineering staff. For example, he insisted that the AC frequency standard be 60 Hz, not the 133 Hz Westinghouse standard. Time and time again, he would leave in a furious protest, only to come back when the engineers subsequently discovered that he was right (Hunt and Draper [1964] 1981, 45 ff).

The AC versus DC controversy became known historically as the "War of the Currents." The opposition was the consolidated company, General Electric for DC current, and the Westinghouse company for AC. With Tesla's designs now in a working, practical system, the superiority of AC was inevitable among engineering thought—provided that it survived the politics, polemics, and financial stakes.

The War of the Currents will make up a significant portion in the next article on Tesla's technical accomplishments. To make a long story short, ultimately, Tesla, Westinghouse, and Brown won the war against Edison, J.P. Morgan, and Thompson-Houston. The very electrical power system we, as a technological culture, take for granted had to be fought for with every bit of cunning and conviction that a small group of men could humanly muster. The glorious high points and battles won in this war of technology include the 1893 Chicago Exposition, the generating plants at Niagara Falls, and the fact that General Electric finally had to purchase license agreements from Westinghouse to use the AC patents.

Tesla's attention turned next to where he could perform his experiments without hindrance. His company was paid for and funded by Westinghouse through loans, agreements, and large amounts of money that Tesla had earned by selling his AC patents to Westinghouse. The Tesla Electric Company went through several stages of growth, name changes, interest, financial and entrepreneurial support for some forty years or so starting in the late

1880's. The first laboratory was at 33-35 South Fifth Avenue, New York City. From all descriptions, for the first few years that it existed, it was probably the most technologically advanced laboratory in the world, including Edison's. Tesla promised to have great advances in radio, remote-controlled machines, cryogenics, hydraulics, and power systems on the market soon. I'm skipping over some of the details, as I need to arrive at what happened to Tesla on March 13, 1895. The six-story building that the laboratories were housed in burned to the ground. Historically, we have only the word of Tesla and his assistants for the magnitude of loss to the advancement of technology on that fateful morning. This event is the pivotal change that directed Tesla toward his Period of Decline. Tesla had no insurance, and the financial backers that he called upon, one-by-one withdrew their support for possible reconstruction. He was never again able to assemble the sophisticated and diverse equipment in one laboratory (Cheney [1981] 1983, 96).

Some inroads were made to regain some financial support in the two years following the fire, but where to from there? With the Paris Exposition of 1900 just a couple years away, Tesla decided to demonstrate, in grand style, what he considered his finest contribution to mankind, the wireless power and broadcasting station. To that end, he needed to build a laboratory where he would have freedom of action. Fortuitously, his old friend Leonard Curtis, lately involved with the Colorado Springs Electric Company, invited Tesla to Colorado with the promise of free land, building, and power for his experiments. Arriving in May of 1899, Tesla found the climate, the crisp clean air, and the mountains invigorating. His carpenter was Joseph Dozier, quite skilled and able to understand the unusual vision for the building. During the construction phases, Dozier and Tesla had a rapport that included discussions of mysticisms. A flurry of telegrams to New York and back constantly described Tesla's need for various kinds of equipment. By July, the basic system was operational. It would be another few months before the laboratory reached its final form though (Hunt and Draper [1964] 1981, 105 ff).

Of the several things that Tesla accomplished in Colorado, such as discovering "stationary waves," the reception of radio waves from stellar sources (he said it was Martian technology), and the mighty finale of the 150+ foot electric arcs, not one discovery ever became the basis of a renewed fortune for Nikola Tesla. His contribution to science at this time was probably much less than he claimed to his financiers. One interesting development of the "stationary waves," discovery was his contention that there was a special class of electromagnetic radiation that he called "scalar." The controversy surrounding his claims in Colorado will be examined in both the articles to come (McBirnle 1987, 6). Once back in New York, in January 1900, he set about the business of financing and constructing his "world power and broadcasting" facilities. But money wasn't easy to obtain anymore. Despite his claims of success in Colorado, most financiers saw little benefit to continuing his efforts (Cheney [1981] 1983, 169 ff). By 1905, others were stealing Tesla's thunder. Most notably, Marconi was developing practical radio systems, and capturing worldwide interest. The one man that Tesla had most feared during his halcyon days was J.P. Morgan. Having resisted Morgan's financial grip for so long, Tesla finally succumbed to the offer of capitalization, with all the strings attached. He selected a site on Bong Island that he dubbed "Wardenclyffe." This was to be his stand against a tide of radio technology rushing-in from Europe. But money was slow to come, even from Morgan, and the tower was never really finished. It is ironic that German technologists offered him the most hope for implementing his ideas in remote-control weaponry, the Wardenclyffe demonstration, remote underwater sensing, and a realized fortune again. But Tesla was to be disappointed again: World War I not only broke those opportunities, but his income from European patents ceased, and

the U.S. War Department was not interested in what the Germans sought from Tesla. In a final humiliation, the Wardenclyffe tower was demolished for salvage on the “threat” that German agents could use its lofty view to observe shipping in and out of New York (Hunt and Draper [1964] 1981, 133 ff; Cheney [1981] 1983, 174).

One rather strange episode occurred to both Tesla and Edison in 1915. It was announced that the two men would share the Nobel Prize in physics. When the reporters descended on both men, they each said that they hadn’t received official notification from the committee. Each speculated why they would receive the award if earned. Certainly Tesla could use the honor and the monetary gain. However, a short time later, the awards committee officially announced that the father-and-son team of William L. Bragg Sr. and Jr. would receive the prize for their study of crystal structures by x-ray diffraction. This is a mystery that has proven insoluble to this time, and Tesla didn’t need the disappointment. Contrary to some prevailing opinions at the time, Tesla would not have refused the award (Cheney [1981] 1983, 195–197).

So the World War dramatically accelerated the pace of his Period of Decline. After the war, Tesla tried what was to be his last great push in technological advancements. The bladeless turbine that he had conceived at age four became his new means to regain fortune. Having built several prototypes over the previous quarter of a century, Tesla felt well able to construct an industrial model. Through various sources, he gained and spent at least \$30,000 for the model. At each stage Tesla claimed victory, and then another time-consuming problem would present itself. Unfortunately for Tesla, the metallurgical sciences of the day could not produce the alloys needed to survive the stresses that the turbine generated for industrial demands (Hunt and Draper [1964] 1981, 161–164).

From about 1925 on, he was never again a real factor in the advance of American technology, especially in the way he had in bringing AC power to fruition. Tesla’s mind was still keen and brimming with new ideas. For another decade at least, he would write to companies, announcing his latest way of solving their problems. Magazine articles authored by him announced the coming utopian age of technology. Speculations on the future art of war, the distribution of free power, and ideas of what the Wardenclyffe project would have accomplished permeated his writings (Hunt and Draper [1964] 1981, 172–180). Around him were a core of loyal workers, much more youthful than he was. By this time his early supporters, the Johnsons, Twain, Westinghouse, and others, had long since passed on. The loyal remnant were by-and-large staying with Tesla in the belief of his resurgence, defending his reputation of days gone by. From the early part of the twentieth century, Tesla’s keenest loyalists were George Scherff, his personal assistant; Kolman Czito, another long-term assistant; and Dorothy Skerritt and Muriel Arbus, his secretaries. They all showed their strong dedication to Nikola Tesla. They all were willing to forego paychecks when the financial necessity bore down on Tesla. They ran interference with creditors, sometimes loaning money to Tesla without his knowledge. Tesla was generous in kind to his friends and employees. He would loan money to Robert Johnson or anyone else that he cared for even if he didn’t have the resources to sustain himself. Tesla was very good about making-up back paychecks with his staff whenever the money was available. There were other staunch Tesla supporters among journalists, such as, Robert Johnson of *Century Magazine*; Kenneth Swezey, a science writer who contributed to Tesla’s public exposure at the end of Tesla’s life; and Hugo Gernsback, science fiction author and Tesla admirer. One mustn’t leave out mention of John O’Neill, who not only wrote the most definitive biography that stood for many years, but was the one person that had the greatest exposure to the mystical side of Tesla’s nature—O’Neill was himself interested in spiritism (Hunt and Draper [1964] 1981,

192–193 et passim; Cheney [1981] 1983 1–2 et passim).

Tesla's preferred lifestyle was one of first-class living and treatment. During his halcyon years and for sometime thereafter, he lived at the Waldorf Astoria. The declining years forced several moves to lesser hotels upon him. In all this, he maintained the height of a Victorian gentleman's charm, manners, and demeanor. Perhaps it was a variety of life's stresses, or his upbringing, a withdrawal from society, or maybe his manifested superstitions that led him to care for pigeons. He would daily feed the birds in the park and look for injured or sick pigeons, taking them back to his hotel where he'd nurse them back to health. Tesla's obsession with the care of the birds finally transcended his laboratory work (such as it was) to the extent that he would deny his work for days at a time to nurse them back to health. When he was sick himself, he would have members of his staff or paid messengers go out and feed the pigeons in the park on his behalf (Cheney [1981] 1983, 225–231 et passim; Hunt and Draper [1964] 1981, 193).

This aspect of his life is described above in order to explain an interesting episode in the life of a great man in decline. For a number of years Tesla had a particular female pigeon for a pet. It was nearly perfectly white, and had grey wing tips. Tesla described it as having a telepathic relationship with him, especially as described by O'Neill: if it was sick or needed Tesla, he would know it. And if Tesla was sick, that bird would come sit with him. He felt that some of his impressions of destiny and of significant accomplishments to come were telepathically introduced by that special bird. Significantly, about 1922, the bird became ill and Tesla was distressed. He told O'Neill later that the bird flew-in one afternoon, and he sensed that the bird was telling him that she was about to die. With that, a bright beam of light emanated from her eyes, dissipating its life energy in a single flash. Until that time, Tesla felt like he could fulfill his perceived destiny. But the passing of his special white dove (in reality a pigeon) made him realize his mortality, and his career would be unfinished. I believe that he gave up at this time, despite his prolific oratory about what he was going to be doing next in the world of engineering and science (Hunt and Draper [1964] 1981, 192; Cheney [1981], 1983, 229).

His death, in January of 1943, saw his native land under the dominion of the Nazi war machine. He couldn't understand it, but Yugoslavia was destined to be communist. He was bewildered why Serbians would be fighting Serbians (Cheney [1981] 1983, 258–263). He couldn't understand why the world was no longer beating a path to his door, as it had done a half-century earlier. In a display of respect and honor, a few years earlier he had received tremendous accolades from scientists, journalists, politicians, and engineers from all over the world. But it was somewhat hollow, and Tesla knew it. He was grateful for the recognition, but where were those supporters when his career needed them (Cheney [1981] 1983, 237–242).

In the next two articles I will deal with some of the questions that this article has perhaps raised in the mind of the reader. From turbines to pigeons, a proper analysis of this complicated man would take virtually a lifetime. I have only dealt with a variety of favorite aspects about Tesla, but with a special intent to give as balanced a view of those triumphs and failures as possible in brief survey.

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