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(1897–1900) of robots and rhetoric:
Nikola Tesla's telautomaton
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Public Understanding of Science
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I. Introduction

This article examines the historical moment surrounding Nikola Tesla's invention of a radio-controlled submarine boat in 1897. Before this moment, in the early 1890s, Tesla's rich theoretical understanding of electricity and novel experiments with high-frequency currents and oscillators, later named "Tesla coils," informed his lectures to scientists and engineers at the American Institute of Electrical Engineers, the Royal Society, the French Society of Physicists, and the Franklin Institute. Tesla was celebrated as a "pioneer in electric science" (Hospitalier, 1892: 195) across North America and Europe. His scientific standing was further solidified with the publication of his first book, *Inventions, Researches, and Writings of Nikola Tesla* (Martin, 1894). Yet, a few years later, Tesla began to engage with the philosophical debates related to automaton theory and he failed to accurately communicate his ideas and the practicality of his inventions. These actions splintered the consensus about Tesla's scientific credentials.

Previous biographers have noted that Nikola Tesla's bombastic claims and futuristic visions increasingly overshadowed his later research and innovations. Iwan Rhys Morus (2019) suggests Tesla's public pronouncements made him appear as a "dreamer of electric dreams" (pp. 136, 157) that played with the boundaries of fact and fiction. Bernard Carlson (2015) argues that Tesla matched his scientific theories and material inventions with popular illusions in his early career but, between 1894 and 1904, when Tesla was "at the height of his creative powers," he "concentrated more on creating illusions than converting his ideals into working machines" (p. 11). What was the source and impact of those illusions? What pushed Tesla from the fields of science into pseudo-science and science fiction? What can Tesla's rhetoric teach us about science, technology, and communication in the so-called age of electricity?

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Here, I offer initial answers to these questions by examining a critical moment in Tesla's career and one of his most underexamined inventions—the telautomaton. An automaton is an independent machine that is programmed to perform various functions. In 1897, Tesla built a *tel*-automaton, a radio-controlled submarine boat that was one of the first machines to receive instructions through wireless signals. Tesla envisioned his invention leading to a line of increasingly complex robotic weapons that would fight each other and thereby erase the human casualties of war. After building a prototype, Tesla's (1900) rhetoric quickly escalated, as he launched into Faustian decrees, suggesting that he was on the cusp of building a machine, "embodying a higher principle, which will enable it to perform its duties as though it had intelligence, experience, judgment, a mind!" (p. 134). Tesla's contemporaries questioned his methods and results. *Scientific American* (1898b) noted Tesla was prone to "flamboyant rhetoric" and wondered, "What possible good can be done either to the inventor himself or to the great cause of science, which [Tesla] is presumably desirous to promote, by confusing the minds of the public by such unscientific exaggerations?" (p. 322). Some parts of the popular press accepted and even promoted Tesla's visions, but many scientists and established science journalists did not.

The allure of science popularization was partially responsible for Tesla's downfall—the media eagerly sought and published his sensational statements and his visions of the future as if they were fact. Yet, Tesla was also a tragic figure, an original thinker who refused to acknowledge the limitations of his devices and the faults in his theories about wireless transmissions of power. Rather than refine his thinking, defend his theories to scientific critiques, and help establish disciplinary boundaries in the new field of wireless signaling, Tesla veered further toward philosophy and futurism.

This historical moment sheds new light on an important figure in the history of science and technology and offers another case of what Massimiano Bucchi (1996) had identified as "deviations" from the continuity model of scientific communication. The continuity model suggests scientific knowledge is produced and shared within disciplinary circles before it is translated to a passive public. Bucchi (1996) contends the public and mass media are not always passive, but can, through feedback loops, interact directly with the lab stage of science communication (p. 381). Tesla was often private, sometimes even to the point of being a recluse, but during this moment, his direct engagements with the public simultaneously sparked wonder in the masses and initiated the dissolution of his scientific reputation. Tesla's demise was tied to his inability to achieve a middle ground between futuristic and, in hindsight, prescient pronouncements and more measured, orthodox forms of science communication. While it seems that Tesla failed in the moment, science communicators and innovators should continue to strive to find this balance in our modern media ecosystems.

2. From "My Destroyer" to "The Problem": Tesla's failure to communicate

In May of 1898, Tesla gave the first public display of his telautomaton submarine boat at the Electrical Exhibition at Madison Square Garden. Months earlier, the battleship *Maine* had been sunk in the harbor of Havana, Cuba and on the 25th of April, the United States declared war on Spain. Inside the hall, Tesla's submarine boat moved around an artificial pool with a control box mounted on the rim. Visitors were encouraged to direct questions to the device as if it were an independent, thinking machine, but Tesla himself answered the questions by sending wireless signals to blink lights attached to the antennae.

Tesla's conflation of *auto*-maton and *tel*-automaton hints at how, in his mind, humans and machines were enmeshed. Tesla's early studies of renowned scientific figures such as Hermann

Von Helmholtz, Thomas Henry Huxley, and Herbert Spencer informed this view. For example, Tesla embraced the premise and conclusions of Huxley's lecture, "On the Hypothesis that Animals are Automata." Huxley (1874) argued that all actions of lower animals are "the products and consequences of their mechanical arrangements" (p. 365). Tesla's materialistic view of the nervous system, sense perception, and consciousness spilled into his thinking about electronics, where he believed that he might be able to recreate the "external stimuli" that caused nerve reflexes in sensory organs with wireless vibrations (i.e. "stimuli") and sensitive receivers (i.e. "organs"). That Tesla wanted to build a telautomaton that could prove automata theory is supported by an undated and unpublished essay held in the Nikola Tesla Museum, in which he wrote, "A scientific man, in order to prove his theory, must be able to substantiate it in some or other way." He continues, "the best way to demonstrate it is by a practical working machine. If it be true, that we are automatic engines, why not, then, endeavor to construct such an engine?" (Tesla, n.d.).

Tesla's endeavor to construct a lifelike telautomaton or an "automatic engine," would not be fruitful. However, 6 months after the Electric Exhibition, he secured US Patent 613,809: "Method of and Apparatus for Controlling Mechanism of Moving Vessels or Vehicles" (Tesla, 1898a). [AQ: 1]

The patent stipulates that the submarine boat could be controlled "as long as the body remains within the active region" of the "currents, waves, impulses, or radiations" (Tesla, 1898a). Tesla was one of if not the first engineer to use electromagnetic waves to control an unmanned vehicle. His method of radio-signaling was "among the most sophisticated devices Tesla created in his career" (Carlson, 2015: 229). Yet, the potential to exploit this innovation and the device's contribution to science each seemed eclipsed by Tesla's media blitz.

On the same day the patent was awarded, the *New York Herald* published "Tesla Declares He Will Abolish War" (Christman, 1898: 6). In the interview, Tesla explained that his prototype would eventually be developed as a low-cost torpedo-laden boat. This weapon would empower relatively weak nations, making their "coasts secure and its port impregnable to the assaults of the united armadas of the world." The journalist then narrates a play by play of a lab demonstration given by "one of the great magicians of science." Tesla stood at the switchbox and gave the lever a sharp turn:

Instantly, the little bronze propellor began to revolve at a furious rate. "Now I will send the boat to starboard," [Tesla] said, and another quick movement of the lever sent the helm sharp over, and another movement turned it as rapidly back again. At another signal, the screw stopped and reversed.

Tesla could make the boat move left and right, dive, surface, and blink its lights. Today, such actions might seem rudimentary, yet this article brought readers into Tesla's lab and helped them imagine machines controlled by invisible forces and fleets of mechanical "destroyers" sailing into the din of war.

Tesla's own prose was just as purple. In "My New Submarine Destroyer," Tesla (1898b) introduced his invention as, "the greatest weapon of the navy from this time on" (p. 20). For approximately "\$50,000 or less" (compared to the US\$500,000 for the largest destroyers in use), his planned 36.5-foot submarine boat equipped with six 14-foot Whitehead torpedoes will have the ability to stealthily enter harbors to attack anchoring ships or "go out to sea and circle about, watch-ing for its prey." [AQ: 2] The devices would not literally "watch" or "hunt" their enemies; they would be monitored by a person or team and maneuvered with a control box located on shore or a larger ship, which would also serve to transport and launch the destroyers. Tesla (1898c) concludes by bragging that, of course, to the average reader his latest invention will seem "simple enough" because, "I have worked all my life to make each one of the details so simple that it will work as easily as the electric ticker in a stockbroker's office" (p. 20).

AQ: 2 Please replace with following sentence: Tesla estimated that large destroyers cost US \$500,000, but for "\$50,000 or less," his 36.5-foot submarine boat equipped with six 14-foot Whitehead torpedoes would stealthily enter harbors to attack anchoring ships or "go out to sea and circle about, watching for its prey."

Scientists and technical writers saw Tesla's rapturous rhetoric and the attractive drawings of his submarine boat as misleading. Tesla assured his readers he had adequately translated complex electrical signals into a "simple" machine, but the device did not work that easily and his peers were not convinced of its scientific ingenuity or practical value. Thomas C Martin, who had been Tesla's early editor and champion, published an article in the *Electrical Engineer* that shifted from the practicality of Tesla's patents to personal attacks. One professor explained, "the announcement is most amazing, and, coming as it does from Tesla, scientists are all the more chary about accepting it," and another, Professor Brackett of Princeton said,

There is nothing new about [Tesla's patent]. The theory is perfect, but the application is absurd . . . what is new about it is useless, while that which is useful had all been discovered by other scientists long before Tesla made this startling announcement. (Martin, 1898: 491)

In the same issue, Martin published a copy of Tesla's recent lecture at the Electro-Therapeutic Society without the author's permission.

Likely incensed by the critique of his submarine boat and slighted by the unverified publication of his lecture, Tesla sent an open letter to various scientific journals and trade magazines, first lamenting that his lecture, which he had taken "great pains to write," had been released by *Electrical Engineer* without consent. With this score settled, Tesla turned to the professors' comments, which he would have easily dismissed, if they had not amounted to a "slur," that "cast a shadow on my honor" and all the universities from which Tesla had received honorary degrees. Tesla (1898c: 314) would accept nothing less than a "complete and humble apology" and warned that any future assaults would be "liable to be punished by law" . In this and subsequent letters and interviews, Tesla did not defend his patents, clarify his methods, or acknowledge any limitations of his proto-types. Unsurprisingly, the challenges to Tesla's scientific credibility continued.

On 19 November, *Scientific American* (1898a) ran, "Nikola Tesla's Latest Invention," with this lackluster introduction: "Apart from its value as an excellent subject for sensational newspaper articles, Mr. Tesla's invention presents certain aspects which are, perhaps, not uninteresting from a scientific point of view" (p. 322). Another article in the same issue, "Fact and Fancy," indicates that Tesla's media campaign had cast a pall over any scientific merits or electrical innovations his patent might contain: "Unfortunately for its reception by the thinking public, Mr. Tesla's improvement has been introduced to the world with some of the most extravagant rhapsodies that ever threw discredit upon an untried invention" (*Scientific American*, 1898b: 326). Weeks later, *Scientific American* (1898c) followed with, "Science and Sensationalism," which explained that science had become a "favorite hunting ground of the reporter, and whole pages of the yellow journal seventh-day editions are loaded down with pseudo-scientific pabulum, upon which the Sunday reader is supposed to satisfy his hunger for scientific knowledge" (p. 338). Again, Tesla exemplified this "pseudo-scientific pabulum," and, by the end of 1898, consensus was shifting. Tesla may be a wizard, but he was not a scientist; certain colleagues and publications felt it was their duty to make it clear that Tesla was endangering the "thinking public."

As Tesla left New York City bound for Colorado Springs, his standing as one of, if not *the* great-est inventor in the world was on shaky ground. Tesla had reasons for going to Colorado to conduct his wireless experiments, but by leaving New York City, Tesla also seems to have been fleeing the harsh reality that his "illusions," would not, in his lifetime, or under his direction, become material fact. If he was fleeing, he was also aiming, striving for something seemingly beyond worldly success, a brave new philosophy, an electrical theory of everything that, more or less, would use science to prove the relationship between technological progress, consciousness, and human evolution.

Glimpses of Tesla's less scientific and more philosophical mind-set appeared in May of 1899, when he stopped in Chicago to lecture to members of the exclusive Commercial Club. One journalist described Tesla's presentation as "rather disjointed and disconnected . . . punctuated with experiments and side remarks" (Serviss, 1899: 285). As a way of introducing his display of the radio-controlled submarine boat, Tesla said the function of memory is "automatic." Our brains record every experience, or, to use a contemporary analogy, the central processing units (CPUs) inside our craniums register every keystroke. Tesla said he himself was, "nothing but an automaton in every act and sense." "If I am an automaton," he opined,

why should I not construct, an automaton like unto me? What are the elements necessary? I am a heat generating being, with powers of locomotion, with machinery to direct my movements, with a sensitive mechanism to provide data, and with a governing mind. My automaton must have all these qualities.

It is not clear when Tesla began to speak at the Commercial Club that evening, but he kept the audience "well past midnight," and guests were too tired (or bewildered) to respond. Days later, Tesla's lecture had inspired, "no small amount of comment and criticism" (Serviss, 1899: 285).

Over the next 6 months, in the shadow of Pike's Peak, Tesla constructed a special laboratory including an 80-foot wooden tower from which extended a 142-foot metal rod topped by a large copper sphere that shot electrical impulses into the atmosphere. Inside the lab, a massive high frequency oscillator emitted sparks up to 30-feet across the room and sent electrical vibrations through the earth. With the land around the lab charged, lightbulbs planted in the soil glowed like skinned onions without any connecting wires. When the sparks ceased, Tesla (1901) said his instruments could detect far off lightning storms and he could, "feel the pulse of the globe, as it were, noting every electrical change that occurred within a radius of eleven hundred miles." **[AQ: 3]**

Tesla's statements about using electric instruments to "feel" the pulse of the globe reflect his flair for the poetic and seem to resonate with the "body electric" Walt Whitman had envisioned in 1855. However, Tesla saw himself as more than a poetic or metaphorical conductor of electricity; he envisioned a world shaped by his wireless network and his devices bringing about the electrification of the entire planet. To explain his worldwide wireless system, he said "the whole earth is like a brain, as it were, and the capacity of this system is infinite" (1902). **[AQ: 4]** Tesla believed that from his brain would spring the system that would electrify the world's brain. He viewed his efforts to build lifelike automatons and worldwide wireless networks as part of an overarching evolution of the human species that would be sparked by "increasing human energy."

Upon his return from Colorado Springs, Tesla penned his manifesto, "The Problem of Increasing Human Energy: With Special References to the Sun's Energy." Against the advice of his friend and *Century* magazine editor, Robert Underwood Johnson, Tesla refused to limit his article to explaining the wireless research he had just completed. Tesla's unwillingness to balance scientific fact and rhetorical flourishes pushed the essay toward a bleeding edge of fact and fiction, scientific research and visionary quest. About a third of the way through the 22,000-word essay, Tesla (1900) again boldly declared, "I am an automaton endowed with the power of movement, which merely responds to external stimuli beating upon my sense organs and thinks and acts and moves accordingly." This was just one indication of Tesla's willingness to be provocative. The censor that had ruled the scientist had been removed by the mystic. He had fully broken with the conventions of scientific communication. "The Problem" drew fierce criticism.

In *Science*, journalist Jay Wright identified the "three different kinds of writing" that appear in "The Problem": (1) descriptions of electrical experiments and results, (2) prophecies, and (3) philosophical arguments. Wright shows his exasperation with this third thread in Tesla's (1900) article with purposefully choppy list of subjects Tesla's philosophizes about in his essay:

Add
"Talking
with the
planets"
to Refs

Add
letter to
JP
Morgan
in Refs

things in general-about human life-what it is-the future of the solar system-the solidarity of the human race-the Christian religion-vegetable food-theoretical dynamics-athletics in colleges-drinking water-ozone-education of women-ice-fertilizers-insanity-warfare-flying machines-iron manufacture-aluminum-liquid air-self-acting engines-the inhabitants of Mars-etc., etc., etc. (p. 448)

Tesla's arguments, Wright implied, could have been effective if the author separated and identified the three distinct genres and submitted his writing to distinct discourse communities. Combining them into a broad manifesto left Tesla open to the charges of being too philosophical and, as Wright (1900) concluded, the "value of Mr. Tesla's general philosophical speculations and opinions is exactly nil" (p. 450). A significant part of the public sphere, somewhat confused by Tesla's flights of fancy, remained skeptical of Tesla's scientific claims.

Some scientific publications offered equal blame to Tesla and the popularization of science. In "Newspaper Science," Tesla's former friend Martin (1900) applauded the various critiques to Tesla's essay, suggesting that such rejections are "the imperative duty of men of science" (p. 684). The general public was "hungry for the easy exposition" of scientific work of "the head-line variety." Indeed, as Morus (2019) explains, Tesla enjoyed these "boom years for popular science," and science fiction often appeared alongside articles by or about Tesla in *Pearson's Magazine*, *Cassell's*, or the *Century* (pp. 181, 179). However, contemporaries like Martin (1900) begrudged this popularization and claimed that newspaper science tended to "dull the scientific sense and corrupt the judgement of the great majority of readers" (p. 685). Martin and others used Tesla as the prime example of how *not* to practice science or scientific communication.

3. Tesla, deviations, and webs of communication

In the early 1890s, Tesla's lectures, patents, and other publications helped establish the use of alternating current systems, the study of high-frequency currents, and other wireless applications of electromagnetism. Yet, by the late 1890s, Tesla had fully deviated from the continuity model of scientific communication to embellish the pending impacts of his telautomaton and the worldwide wireless system he would build at Wardencliff. After 1900, Tesla continued to file patents, give interviews, and make provocative claims about the future. He was also admitted to the New York Academy of Sciences in 1907 and received the Edison Medal in 1916. However, during the twentieth century, Tesla's scientific reputation faltered, and he remained vague about what he had accomplished and what could be accomplished.

Tesla's establishment of radio-control and his visions for its future applications can be seen as foreshadowing for drone warfare and artificial intelligence. Yet, in its historical moment, Tesla's actions reflect another instance of deviation from the continuity model of scientific communication outlined by Bucchi (1996). Instead of patenting his submarine boat and simultaneously establishing the scientific underpinnings of his radio-controlled systems, Tesla moved directly from prototype to promotion. He chose not to directly contribute to the boundary work involved in defining and clarifying the scientific phenomena related to new wireless technologies, including the automaton. Science journalists at the time responded by reinforcing the demarcations between what Bucchi identifies as "orthodoxy (science) and deviance (non-science)" (Bucchi, 1996: 383). Tesla's "deviations" found an audience in popular newspapers, but they did not earn him scientific support or financial backing. Unlike B Stanley Pons and Martin Fleischman, who initiated the cold fusion saga in 1989, Tesla did not have the luxury or the wherewithal to "retire into bounded communication niches" (Bucchi, 1996: 385).

The comparison between Tesla's telautomaton and the cold fusion saga deserves further unpacking. Like Pons and Fleischman, Tesla appealed directly to the public through mass media and the

response of the public and the scientific community reveal distinct communication feedback loops. As Bruce Lewenstein shows, “From Fax to Facts,” one reason Pons and Fleischman deviated from traditional channels was to establish their priority in a new area of scientific research. Like Tesla, they made a major public announcement and initially refused to reveal the specifics of their apparatus. The announcement was then followed by a period of instability in the scientific community and then splintered into a complex web of communication contexts that crossed between scientists, mass media, technical news, journals, policy reports, grant proposals, and so on (Lewenstein, 1995: 426). Mapping those webs and also showing how they stretch from the present to the past seems increasingly urgent. On one hand, Tesla’s automaton and the cold fusion controversy suggest that, for over a century, when public pronouncements by fringe scientists gain mainstream media attention, the traditional flow of scientific communication from lab to mass media can reverse, allowing information gleaned from mass media to impact the direction and focus of scientific research. On the other hand, in a digital landscape filled with fake news and now injected with a deadly, global pandemic, it is as difficult and crucial as ever to maintain the safeguard mechanisms of scientific discourse, while simultaneously communicating the latest scientific research with the kind of wonder, urgency, and authority that, for a time, Tesla transmitted.

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- Tesla N (1900) The problem of increasing human energy: With special reference to harnessing of the sun's energy. *Century Magazine*, June, pp. 175–211.
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Author biography

[AQ: 9]

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AQ3 Please add to references:

Tesla N (1901) Talking with the planets. *Collier's Weekly*, 9 February, pp. 4-5.

AQ4, Please add to references:

Tesla N (1902) Letter to JP Morgan, 9 January, 1902, qtd. in Carlson p. 339.

AQ8: Milica Kesler from the Tesla Museum in Belgrade confirmed this quote and informed me the reference they use is Tesla, Nikola, "The Human Being is An Automaton." Unpublished article. Nikola Tesla Archives, MNT, CCCXXXIII, (333), 8; Nikola Tesla Museum, Belgrade, Serbia.

I have seen this item elsewhere cited as: Tesla, Nikola, Box 4, DOI 333-1, Activity - Telemechanics - Physical Life as Teleautomatics, Nikola Tesla Archives, Nikola Tesla Museum, Belgrade, Serbia.