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Edison and science: a curious result

Ian Wills

Unit for History and Philosophy of Science, F07 Carslaw Building, The University of Sydney, 2006, Australia

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ABSTRACT

In November 1875, Thomas Edison made the sensational announcement that he had discovered a new force of nature, etheric force. It was to emerge some years later that the phenomenon Edison described was a form of wireless transmission, but Edison failed both to advance his theory and to exploit his discovery in new inventions. I contrast Edison's approach to doing science with what he did when inventing, and also with the approach used by his principal scientific opponents. This contrast reveals that he failed, not so much because he was an inventor who did science badly, but because when he ventured into scientific theory-making he abandoned key techniques that made him America's most successful inventor. From this I argue that we can identify artefact creation processes in science that parallel the process of invention, and that Edison failed because his opponents created better artefacts.

1. Introduction

In part, this is an exploration of why Thomas Edison, holder of 1085 patents for inventions ranging from electric lighting to preserving fruit, was not the inventor of wireless telegraphy. It is also an exploration of why Edison, who financed the establishment of the journal *Science*, should have had his claim that he had made an important scientific discovery rejected by the scientific community of his day. The controversy over his discovery began in November 1875, with Edison's startling public announcement that he had discovered etheric force, an 'entirely unknown force [of nature], subject to laws different from those of heat, light, electricity or magnetism' (TAEB D678).[1] Interest in etheric force burned brightly in public and in Edison's laboratory over the following five weeks, then waned. Edison's venture into public scientific theory-making eventually ended the following July, when he privately accepted his opponents' explanation of the phenomenon he had observed. Edison not only failed to have his theory accepted, but also failed to exploit a phenomenon that fell within an area in which he was an acknowledged expert, communication technologies, for the phenomenon he observed was wireless transmission.

A number of historians have addressed the etheric force controversy. Süsskind (1964) refers to it in his survey of the many observations of wireless phenomena before Hertz, while Hounshell (1980) examines it in his exploration of the relationships between Edison and scientists. Carlson (1991, p. 63) and Israel (1998, p. 114), have attributed Edison's failure in the etheric force debate to his scientific naïvety, particularly his use of the popular, rather than scientific, press to publish his claims. I will argue that while this may have been a factor, Edison failed because of something more fundamental. It lay in his beliefs about how to do science. This, in turn, reveals that he failed, not so much because he was an inventor who did science badly, but because he was an inventor who abandoned successful invention techniques when he engaged

E-mail address: iwil2506@usyd.edu.au

[1] TAEB citations refer to documents in the Edison Papers book edition. Fifteen volumes of the book edition are planned, of which six have been published. Documents in the book edition are numbered consecutively across the volumes and it is the document number, rather than page number, that I have used in the citations. For example, in the citation '(TAEB D679n5)', 'TAEB' indicates the Edison Papers book edition and 'D679n5' document number 679, note 5. Documents cited herein can be located from the following key:

Documents 1 to 340: Edison Papers book edition, Vol. 1 (Edison, 1989a).

Documents 341 to 737: Edison Papers book edition, Vol. 2 (Edison, 1989b).

Documents 738 to 1163: Edison Papers book edition, Vol. 3 (Edison, 1989c).

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in scientific research. While Hounshell considers Edison's relationship with scientists, I use the incident to examine his relationship with science. This, in turn, leads me to examine aspects of the relationship between science and technology and, in particular, technology as manifested in inventing.[2] As an inventor, Edison was primarily in business of making artefacts, things created to serve a purpose or function.[3] Many of the artefacts Edison created were physical, like the incandescent electric lamp and the phonograph, but others were non-physical, like patent applications and companies he created to exploit his inventions. It is being created for a purpose that makes something an artefact, rather than whether or not it has a physical existence. Artefacts are the product of art in the older sense of the word: that is, skill in doing something that comes from acquired knowledge.[4] (Elsewhere I have highlighted the ways in which Edison built knowledge, notably knowledge that came from failures, as he created artefacts (Wills, 2007)).

In examining Edison's relationship with science and artefacts I will argue that the etheric force controversy was a contest of artefacts in which Edison, the iconic inventor and creator of artefacts, was beaten by scientist opponents who created more successful artefacts. It is irrelevant that in later years both Edison's theory and that of his principal opponents, Edwin Houston and Elihu Thomson, were judged to be erroneous. In 1875–1876, Houston and Thomson's theory was more successful because it was more convincing. While it is unusual to view science and the work of scientists as directed towards making artefacts, I will argue that in science artefacts have a key role in the acceptance of theories, and that there are close parallels to that unquestionable artefact creation process, invention.

2. The etheric force debate

The search for a new force of nature began within days of Edison's meeting Dr George Miller Beard, a New York physician and editor of the journal *Archives of Electrology and Neurology* (TAED SB1677:126).[5] Edison was introduced to Beard in October 1874 in connection with one of Edison's inventions, the Inductorium, a device that employed induction coils to deliver electric shocks, and which Edison advertised as 'a specific cure for rheumatism and an inexhaustible font of amusement' (TAEB D434, D435).[6] Beard was an influential figure in late nineteenth-century psychiatry, who had had just published the second edition of his book on the medical and surgical uses of electricity (Beard & Rockwell, 1875). He introduced the term 'neurasthenia', and later published *American nervousness: Its causes and consequences* (Beard, 1881), which was read by, and influenced, Freud (Weiner, 1956). As a pioneer of electrotherapies, Beard hoped to use Edison's Inductorium to treat nervous conditions.

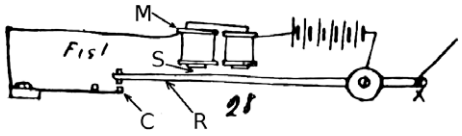

Figure 1. The apparatus (notation added) on which Edison first noticed etheric force sparks (TAED NE1691:15). When the contact C closes, completing the circuit, the iron rod R is pulled towards the electromagnet M opening the contact C, and causing the rod to return to its original position. The process is cyclic, causing the rod to vibrate. In operating principle it is identical to an electric bell.

Beard was also a crusading proponent of science and an opponent of supernatural explanations of phenomena. At the time he met Edison, Beard was engaged in a bitter public debate with Helena Blavatsky, spiritualist and founder of the Theosophical Society (Meade, 1980, p. 127).[7] A few days after his introduction to Beard, Edison made the first notebook entry describing a series of experiments on 'Odic magnetism' (TAED NS7401:43–46). It is likely that Beard's current public opposition to spiritualism may have led him to discuss with Edison the Odic force theories of the German chemist, Karl von Reichenbach. In the 1820s and 1830s, Reichenbach (1788–1869) had built a credible reputation in chemistry, mineralogy, and antiseptics.[8] In the 1840s, Reichenbach turned to investigating the effect of magnets and crystals on humans. His experiments led him to claim to have discovered Od (or Odic force), a mysterious force in nature that he believed pervaded all things and could explain phenomena as diverse as the Aurora Borealis and clairvoyance. Reichenbach's works on Od were translated into English and became popular in the United States.[9] Although Reichenbach's theories received some scientific support initially, this effectively came to an end in 1862 when seven Berlin professors, including the physicist Heinrich Magnus, published a letter repudiating Odic theory (Farrah, 1992).

The lack of support among professional scientists did not deter Edison, who conducted more experiments in search of a new force in May and June 1875. On 31 May 1875, Edison drew up a list of potential research topics, including 'A New force for Telegraphic communication' (TAEB D570, D579, D581). The search for a new force was clearly on Edison's agenda.

During the night of 22 November 1875, while experimenting with the device in Figure 1, Edison and his assistant, Charles Batchelor, noticed sparks at S, a point at which no current should have been flowing (TAEB D665).[10] On investigating further, they found that they could also draw sparks from other parts of the vibrating bar R and from the end of a wire connected to X. When they connected the wire to a gas pipe, they found they could draw sparks

[2] A number of authors have argued that science is a form of technology. Radder (2003) divides these arguments into those based either on the experimental dependence of modern science (for example Janich, 1978, and Lelas, 1993) and those based on the similarities between science and technology under actor network theory (Latour, 1987). Radder dismisses both approaches and it is not my objective to revive them.

[3] Hilpinen (1995) defines an artefact as 'an object which has been intentionally made or produced for a certain purpose' and argues that the term can not only refer to physical objects but can also be applied to non-physical objects, including works of art and belief systems (Hilpinen, 1992, 1995).

[4] Indeed, a patent application can be rejected if it relies on previously public knowledge, referred to in the legal sense as 'prior art' (US Department of Commerce, 2001).

[5] TAED citations refer to documents in the Edison Papers digital edition using the notation recommended by the Edison Papers editors (Edison Papers, 2008a). For example, in the citation, '(TAED SB1677:126)', 'TAED' indicates the Edison Papers digital edition, 'SB1677' is the 'Folder/Volume ID' and '126' the image number in the Folder/Volume. Document images can be accessed through the Edison Papers website (Edison Papers, 2008b) using the Folder/Volume ID to locate the folder, then the image number within the folder.

[6] Edison was fond of practical jokes that involved giving electric shocks to unsuspecting subjects for the amusement of initiated onlookers (Conot, 1979, pp. 25–26).

[7] Beard's skirmish with Blavatsky followed his public claim that two of her favoured mediums were frauds. Edison later had considerable contact with Blavatsky and her deputy, Henry Olcott. Despite his friendship with Beard, and Beard's support for him during the etheric force debate, Edison joined the Theosophical Society in 1878 but appears to have taken no part in its activities (TAED D7802:1, D8912:1–3).

[8] Absolon (1999) claims that Reichenbach used carbolic acid (phenyl) as an antiseptic in 1833, three decades before Lister.

[9] Reichenbach's theories where reported in *The American Whig Review* (Researches of Baron Reichenbach on the 'Mesmeric', now called the Odic force, 1852) and an American edition of his book on Od was published (Reichenbach, 1853). Willis and Wynne (2006) have documented many literary references to Odic force and mesmerism, including some in the works of Edgar Alan Poe. It is likely that Edison knew of Reichenbach before he met Beard.

[10] Charles Batchelor (1845–1910) was an English-born textile mechanic, who joined Edison in 1873 and became his primary associate in invention for twenty years.