Guglielmo Marconi and wireless telegraphy

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Abstract: The contributions of Guglielmo Marconi (1874-1937) as a scientist are emphasized, against his often over celebrated skills as a mere inventor and manager.

Keywords: Guglielmo Marconi (1874-1937), Wireless telegraphy, Science and society.

It would be reductive to consider Guglielmo Marconi (1874-1937) as a mere inventor. On the one hand, it is almost universally acknowledged that he invented wireless telegraphy and radio transmission. On the other hand, however, his scientific contributions in these two fields are poorly known in Italy, and especially abroad. A few years ago, the well-known American scholars F. Seitz and N.G. Einspruch published a book (1998), where Marconi is more celebrated as a manager. Being an effective manager is certainly an important pro for any scientist. However, that book is not fair enough towards Marconi's scientific achievements. For example, these are not sufficiently emphasized against those of Popov, a Russian scientist who provided relevant contributions to wireless signal transmission, but who would not make that necessary leap forward which proved necessary for actual transmission at long distances.

Following the acceptance, on July 2, 1897, of the first patent entitled *Improvements in transmitting electrical impulses and signals, and in apparatus therefor* (sic), on behalf of the British Patent Office, Marconi actually demonstrated a remarkable initiative and managerial skills, such that one would nowadays expect from a young start-upper or developer of a spin-off. He considered the possibility of establishing commercial partnerships with several subjects, including institutional ones, and did not omit to anticipate various legal, therefore more practical, issues. These had to be inevitably involved in establishing a firm, which would be presumably destined to achieve an international reach (Valotti, Dalle Donne, 2015). Within just a month from the approval of the first patent, on July 20, 1897, the Wireless Telegraph and Signal Company, Ltd. was born, sporting a capital of 100,000 stocks worth one pound each.

Such managerial skills, certainly uncommon, tend to obfuscate Marconi's scientific profile. The present authors therefore decided to initiate a correspondence with the authors of the aforementioned volume (Seitz, Einspruch 1998), with the aim of remarking the decisive contributions of Marconi's with respect to those of his contemporaries, with reference to his patents. Seitz kindly replied that his omission had of course not been intentional, and that he had been not aware of those documents, which he would have referred to in a future edition of their monograph.

The extraordinary character of Marconi's work is not limited to the scientific implications (albeit fundamental) of his findings, and to his managerial skills, which were however instrumental towards the success of his inventions. Indeed, Marconi took himself constantly care of the extensions and the upgrade of each single part of the instrumentation, which led to new patents and to substantial improvements in the quality and in the extent of the transmission and receiving of signals. Brits used to refer to him as to "golden hands", since Marconi was able to make any project of his to actually work. He was the first to apply the antenna and the earth plug to the transmitter, not only to the receiver, which enabled him to make use of wavelengths of the order of tens or hundreds of metres, rather than order of tens of centimetres, as it was in use among his contemporaries. Now, it is well known that waves with wavelengths of the order of a few centimetres would not be able to by-pass obstacles as high as a building, or as Pontecchio's hill, close to where Marconi performed his first experiments, while the waves employed by Marconi were indeed able to overcome such hindrances.

Immediately after the establishment of a first factory in Chelmsford, at the north of London, and after numerous experiments also in Italy, both in La Spezia and at the Quirinale palace in Rome, where he had the opportunity to be a guest of the sovereign, Marconi worked hard and continuously to the extension and the amplitude of the signals, first between the coasts of England and Ireland, then across the Channel.

Through repeated tests and experiments, he was then able to reduce absorption effects considerably. Moreover, he studied different shapes of antennas, and realized that the wavelength of the emitted wave had a precise relationship with the length of the antenna itself. He had then to face the problem of interference between signals emitted by near sources and worked therefore on tuning, a technique which enables any emission to stay confined in a well-defined frequency bandwidth, thereby avoiding that they can overlap. These findings made it eventually possible to increase the power concentrated in the emitted signals. Similar results had in fact been obtained, independently, by the German researcher Karl Ferdinand Braun. Finally, Marconi was the first to courageously direct electromagnetic waves towards the sky (waves with short wavelength, this time), in the hope to collect them at the other side of the Ocean. This enabled him to achieve some quite spectacular results, which soon became very well known internationally, among which the switching on of the lights of Sydney's municipality in Australia, via an electromagnetic impulse emitted on board of his yacht *Elettra*, at the moor in Genoa, Italy. Certainly, he was not aware of the existence of the Van Allen belt, yet to be discovered in 1958, which reflects the electromagnetic waves, thus enabling them to overcome Earth's curvature. But *fortuna audaces iuvat*, and his

stubbornness, in conjunction with a numerous series of experiments, allowed him to exploit such a belt.

Why, then, have Marconi's discoveries been overlooked to the present extent, and it is only his successful public life that is emphasized? (see, *e.g.*, Falciasecca, Valotti, 2003). This is probably due to the poor public awareness and diffusion of information related to scientific culture in Italy. Overall science indeed does not seem to be of much interest for publishers. However, we surmise that political reasons could also have been the cause of this state of affairs.

After being appointed as a senator in 1914, Marconi was politically linked to Francesco Saverio Nitti. During World War I, Marconi served in several important roles, and in 1919 he was amongst Italy's plenipotentiary delegates at the Paris Peace Conference. On that occasion, Marconi broke off with Nitti, also because of the Free State of Fiume. Marconi developed a profound disappointment for that reason, and also because of the bankrupt of the Banca di Sconto, whereof he was president. As a consequence, in 1923 Marconi joined the Fascism. His relationship with the regime grew stronger when, in 1923, he married his second wife Maria Cristina Bezzi Scali, a member of the so-called Black Nobility, faithful to the Roman Pontiff. In 1928, Marconi was appointed president of the National Research Council (CNR).

Not long before, the celebrated mathematician Vito Volterra had been ousted from CNR, as Volterra had subscribed Croce's Manifesto against Fascism. In 1930 Marconi was also nominated president of the Italian Academy, which had been established to rule over the various academies in Italy. On the contrary, Volterra was dismissed from his role of the Academy of the Lincei, and even from his university professorship.

Marconi, however, opposed to Mussolini's will to merge CNR and the Italian Academy, and acknowledged their distinct functions and roles. He pursued a pro-British attitude in foreign affairs, and never agreed with the Nazi persecution against Jews, from which he clearly stayed clear. Marconi's political views are manifestly contradictory and would require a careful historical analysis, which has not been undertaken, to date. Regardless of his political choices, however, it seems legitimate to celebrate the inventor, who in 1909 was awarded the Nobel Prize for Physics, together with Braun.

In conclusion, we would like to remember Marconi not just as the powerful and influential man, but as the twenty-years-old lad who, while performing physical experiments at Villa Griffone, was a continuous source of enthusiasm for people.

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