The ‘Marconi Relics’
Examining Artefacts at Museo Nazionale Scienza e Tecnologia Leonardo da Vinci

edited by
Simona Casonato

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Guglielmo Marconi: Pioneer of Wireless Communications and Young Italian 'Startup Entrepreneur' Beacon of Inspiration for the Younger Generations

Guglielmo Marconi, the founding father of radio and wireless technology and the first Italian Nobel Prize winner for Physics, was born on 25 April 1874 in Bologna. The son of a landowner, Giuseppe Marconi, and Annie Jameson, the niece of the founder of the Irish distillery Jameson & Sons, Guglielmo received a sporadic education. In 1895, as a self-taught learner, from the family's country residence, Villa Griffone, he transmitted a signal overriding Celestini hill, which was picked up by a receiver two kilometres away: the first wireless telegraphy communication.

His curiosity and passion for scientific investigation led him to explore the electromagnetic theories developed by other scientists at the time, such as the coherer of Temistocle Calzecchi Onesti and Heinrich Hertz's waves. Drawing inspiration from these discoveries, the young Marconi designed the first practical system, creating something that was ground-breaking: wireless communication over long distances. This was Marconi's genius in a nutshell: a brilliant scientist and savvy entrepreneur, he had the means, the opportunity and, above all, the insight to create a revolutionary invention from the unfolding industrial developments, thereby becoming the first Italian 'startup entrepreneur'. His most important legacy indeed lies in the passion, determination and tenacity with which he pursued his dreams and goals through new challenges, all in harmony with his love for his country.

Thus, 150 years after the birth of Guglielmo Marconi, the Ministry of Culture has set up a National Committee to promote the implementation of initiatives directed at multiple audiences both in Italy and abroad during the three-year period 2024-26, in the belief that rediscovering and finding out about this complex and extraordinary historical figure will inspire the younger generations, the adults of tomorrow.

Giulia Fortunato
President Fondazione Guglielmo Marconi
President Comitato Nazionale Marconi.150

The task of reinterpreting the inherited cultural heritage is becoming increasingly important for science and technology museums, tied to the need to give depth to the contemporary landscape through updated representations of the past that align with their social purpose.
This volume continues the journey of historical investigation into the Museum's collections, focusing on the artefacts and documents connected to Guglielmo Marconi that have been assembled since the early years of the Museum.
The 150th anniversary of the inventor's birth has prompted – and permitted, thanks to the resources made available by the Comitato Nazionale Marconi.150 and the Direzione generale Educazione, ricerca e istituti culturali of the Ministry of Culture – a critical re-examination of this heritage, as was the case in 2019 with the collections related to Leonardo da Vinci.
The comparison with material, archival, and bibliographical sources preserved in different institutions and museums has allowed for a reinterpretation of the Marconian collections by means of historiographically updated criteria.
This has opened up the possibility of finding new narratives in these collections, less focused on the traditional theme of individual brilliance and geared more towards understanding the socio-cultural context surrounding the creation of wireless systems.
Adhering, as usual, to a principle of broad accessibility, the research is presented through different media that engage with a variety of audiences: the present open access publication, a podcast conceived as an 'auditory exhibition', a program of activities that has allowed visitors to explore Marconi in his own era.
These initial studies have laid the foundation for a broader cultural project that – thanks also to the invaluable collaborative relationships established for this volume – addresses the crux of the relationship between information, communication and technoscience: a horizon already signposted in the times of Marconi pointing towards developments that are so significant today.

Lorenzo Ornaghi
President
Fondazione Museo Nazionale Scienza e Tecnologia
Leonardo da Vinci

Fiorenzo Marco Galli
Director General
Fondazione Museo Nazionale Scienza e Tecnologia
Leonardo da Vinci

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The permanent Telecommunications gallery at MUST. © Museo Nazionale Scienza e Tecnologia Leonardo da Vinci, 2024

Introduction
Notes on Memory and Museums of Science and Technology

Simona Casonato
Museo Nazionale Scienza e Tecnologia Leonardo da Vinci

In 2024, the 150th anniversary of the birth of Guglielmo Marconi (1874-1937) prompted a necessary reflection on the Italian cultural heritage related to this inventor, entrepreneur, and scientist. Drawing on the history and collections of the Museo Nazionale Scienza e Tecnologia Leonardo da Vinci di Milano (MUST for brevity), this volume brings together the results of this collective effort. Marconi's biography and the history of his contribution to the development of wireless telecommunications have been explored in detail through countless analysis and accounts, featured in books, magazines, television programmes, documentaries, and exhibitions.[1] Within the framework of MUST, Marconi's history has been represented through its collections and a variety of interpretative tools.[2] By inquiring into how these representations were historically constructed and how narratives around Marconi collections can be reinterpreted, this volume addresses the broader question of how we remember and narrate the past of technoscience.

This text was translated from the Italian original version and then it was partially elaborated for the benefit of international readers. As a consequence, some concepts and literature references are different from the Italian version of the introduction.

1 A huge number of biographies on Marconi have been published since he was in his twenties: the Biblioteca Museo Nazionale Scienza e Tecnologia Leonardo da Vinci holds many of them. Here, I will only mention the well-documented works by Raboy 2016, about Marconi's personal life, and by Hong 2001, about the inventor's actual contribution to physics and to the development of wireless technologies.

2 The telecommunications permanent gallery was revised multiple times between 1956 and 2010. The principal curator was Franco Soresini, joined in the 2000s by Massimo Temporelli, with later contributions from Luca Reduzzi and myself. In 2024, it was decided to experiment with a form of a 'sound exhibition' by producing a six-episode podcast (see *infra*).

The relationship with the past, with its material and symbolic layers, is a daily dimension for museums focusing on history, archaeology, anthropology, and art. But science and technology are typically focused on current technoscience, with its demands for expertise, timeliness and, sometimes, urgency. In these institutions, the dimension of collective memory – taken for granted in other types of museums – is often underestimated. These museums – which I will briefly name 'technoscientific museums' – constantly work to fulfil their mission of engaging citizens in contemporary technoscientific processes or, conversely, advocating for citizens' concerns within the expert community, thus present and future concerns are at the centre of their work. However, these museums are also characterised by an institutional mandate to hold and preserve material culture, archival documentation, and library collections related to the historical evolution of technoscience.[3]

Compared to other memory institutions, collective memory here is a matter that is hidden in the deepest layer of the cultural mission. Anniversaries and commemorations have the power to bring it to the surface and to stimulate questions about its nature.

Evelina Christillin and Christian Greco (respectively the president and the director of the famed Museo Egizio in Turin) argued that the culture of memory arises from the practices of remembering the deceased, which unfold in two dimensions: the 'retrospective', characterised by the *pietas*, a personal effort to ensure that certain figures are not forgotten, and the 'prospective', involving glorification and the construction of their fame (Christillin, Greco 2021, 4).

Which specific manifestations of *pietas* and glorification can technical-scientific museums elicit with respect to Marconi and other historical personalities? Which kind of material heritage – artefacts and documents – has been collected in Marconi's name and entrusted to transcend his own time, perpetuating the tale of his achievements? Why these specific elements? How do we understand the complex history of wireless innovation by drawing on these collections? And which kind of collective imagination of technoscience emerges from this act of 'remembering together' an illustrious, deceased inventor (as the etymology of *commemorate* suggests)?

Starting from these questions, the volume first aims to bring the reflection to a museological and meta-thematic level, exploring how over the years MUST has kept the story of the 'father of radio' (as many still call Marconi, at least in Italy) relevant. The authors were invited to revisit episodes in the history of wireless communication by focusing their investigations on the traces of Marconi's earthly passage preserved at MUST, as well

3 The category of museums of science and technology is historically fluid and loosely formalised, as highlighted by Canadelli, Di Lieto 2024 and Spada 2024. I will use 'technoscience' instead of 'science and technology' when I speak of the general cultural domain in which those museums intervene. The term has been used in science and technology studies (STS) for almost four decades, since it was proposed by the philosopher Bruno Latour to underline the interplay of the production of specialised knowledge and the technological development (1987, 29). I use 'technoscientific museums' in order to stress that I am referring specifically to those museums dealing with technological artefacts as the material heritage of scientific practices and artisanal/industrial historical processes. I refer to institutions that, in the early twentieth century, positioned themselves as heirs to the grand universal exhibitions, representing 'progress' and 'modernity' through the display of artefacts symbolising the latest scientific, technological, and industrial achievements, alongside the milestones that preceded them (Canadelli, Beretta, Ronzon 2019). Examples other than MUST include the Science Museum in London, the Technisches Museum in Vienna, the Deutsches Museum in Munich, the Griffin Museum of Science and Industry in Chicago. These institutions are distinct from science centres, with which they are often associated, by virtue of their scope. Science centres, typically, do not hold historical collections; or, if they do, they attribute a different significance to them (Paoloni, *infra*). Moreover, the use of 'technoscience' emphasizes the new conceptual approach of MUST. Traditionally, the approach has been encyclopaedic, offering a taxonomic representation of various technical and scientific branches (as many other museums did in the past). The new general museological guidelines seek to explore these areas of human activity according to a systemic approach (Tasselli 2017).

as in other museums and archives. Unlike the man, these non-human witnesses have the advantage of not having disappeared and, somehow, being able to 'talk' if properly interrogated.[4] These artefacts are the focal point of museological and historiographical investigations that highlight a historical legacy of telecommunications beyond the usual biography of the inventor as the 'lonely hero' of technoscience.[5]

A key outcome of the anniversary was thus that the Italian national science and technology museums developed new historiographical criteria for examining the Marconi collections in depth. In past decades, the artefacts associated with Marconi have mostly been treated as frozen icons of a canonical narrative, largely unchanged since the simplified version that was established in the 1930s. Now a comprehensive philological investigation of these artefacts has been initiated, similar to what happened to other collections, such as those dedicated to Leonardo da Vinci (Giorgione 2009; 2019a; Beretta, Canadelli, Giorgione 2019).

At MUST, the study of collections related to communication history generally lacked engagement with the extensive research and critical reflections that have emerged in the last decades on its material and technoscientific sides, both in the fields of media studies and STS.[6] From the intersections of these two academic fields, this book derived two basic assumptions. The first is that museums are compelled to question the linear and deterministic view of technological developments that characterise traditional narratives of media development. The second point concerns the dialogue between different disciplines, which is essential to understanding the complex phenomena that we call 'media' as they are narrated and presented throughout the museum. In approaching the Marconi collections, we have deliberately sought to juxtapose diverse perspectives that suited our special object of inquiry, following the practical suggestion of the historian Massimo Mazzotti that it is useful to organise the research "around problem-oriented clusters rather than disciplines and fields" to effectively understand the history of technoscience (2010, 12).

It is no coincidence that a reflection on commemoration and collective memory within this special context starts with Marconi, as he played a significant historical role in this regard. In this introductory essay, first I will briefly review the cultural and historical context in

4 In our field, historical research that engages actively with technological artefacts is one of a curator's professional skills (Alberti 2022, 137), as was advocated also by Lucien Febvre, founder of the *Les Annales*: "the most fascinating probably for historians, consist of a *constant endeavour to make mute things talk*, to make them say things about men, which of themselves they do not say, or about the societies which produced them, in order finally to build up between them that vast network of mutually supporting relationships" (Febvre 1973, 34, emphasis added). According to Febvre, historians of technique should equally study humans and non-humans as historical actors (Deshusses 2024, 188).

5 The issue of heroic narratives is a now long-lasting theme for historians and curators of science and technology worldwide. See, for instance, McLeod 2007; Jordanova 2014; Ortoleva 2019; Liu 2024, not to speak of the specific case of the invention of telegraphy analysed by Kubot 2019. The exaltation of individuality was a practice of self-representation that scientists had used since the early modern age (Beretta 2020, 11).

6 In the past the museum has published several overviews of its communications technology collections (Museo Nazionale della Scienza e della Tecnica 1955; 1957; Curti 1971; 1978; Soresini 1995; Sutera, Ronzon 2005); but the detailed development of research integrating perspectives from media studies and STS with those of the museum remains a future endeavour. Media studies have often regarded the museum institution as part of the broader media landscape (e.g., Silverstone 1998; Capaldi 2018; Drotner et al. 2020). Within approaches labelled as 'media archaeology', some scholars have begun to focus specifically on the collections and mission of technical and scientific museums (Parikka 2012). Inside the field of STS, the interest in media technologies is relatively recent compared to other topics (Gillespie et al. 2014; Balbi, Magaudda 2018). The combined perspective from media studies and STS allows us to interpret the MUST collections putting communication, information, and representation practices in relation to the social construction of technoscience that shapes their material foundations. Only recently, through a doctoral research project co-funded by MUST and the Politecnico di Milano, has this approach been actively pursued (Spada 2024).

which Marconi was personally involved in the creation of MUST, an institution that later celebrated him as part of a national scientific Pantheon. I will focus on the type of 'legendary' and mythical narrative constructed around the inventor's biography, which was then translated into an exhibition narrative in the museum through 'his' artefacts. Then I will outline some fundamental issues and conceptual challenges that emerge in curating objects connected to the history of technoscience, and especially to the field of media technology, related to dealing with concepts like past, memory and history within a cultural context mainly oriented by the concepts of innovation and the future.

Musealising Marconi

Guglielmo Marconi directly intervened in shaping the cultural heritage of Italian technoscience. In Italy, during the 1930s, he held institutional roles that led him to actively take part in this field (Paoloni, Reali, Ronzon 2018). Starting from 1896, the international scene and namely Great Britain had been Marconi's preferred context for conducting business, research, and industrial development of his inventions for almost two decades.[7] But between the two world wars he progressively turned his attention to Italy, drawing closer to the Italian government and public institutions. He could count on a unique relationship with the Italian state, by embodying symbolic functions both as a representative of his native country and as a member of the international scientific community. He was appointed senator in 1914 and participated in the Paris Peace Conference negotiations in 1919 supporting Prime Minister Vittorio E. Orlando. Mussolini's government appointed Marconi president of the Consiglio Nazionale delle Ricerche (National Research Council, CNR) in 1927 and president of the Reale Accademia d'Italia (Royal Academy of Italy) in 1930. By virtue of the latter position, he also became a member of the Gran Consiglio del Fascismo (Grand Council of Fascism, Raboy 2016, 424, 554, 571-2). In 1928, Mussolini spoke to Marconi of the need to provide the country with 'living museums' that would showcase the progress of Italian technoscience (Canadelli 2019, 138). The CNR, chaired by Marconi, subsequently undertook a series of actions aimed at creating national collections of historical relics, starting by promoting their exhibition as icons of Italian primacy (*primati italiani*) at the Hall of Science of the *Century of Progress* World's Fair held in Chicago in 1933. This exhibition was intended to become a permanent collection at the Museum of Science and Industry in Chicago, which had initially requested it. The creation of multiple copies of this 'documentation' also became a significant source for the early collection nucleus of MUST (Giorgione 2019b).

In addition to promoting Italian science abroad, Marconi personally supported the establishment of the national museum institution envisioned for Milan by Guido Ucelli (1885-1964), founder and first president of the Museo Nazionale della Scienza e della Tecnica Leonardo da Vinci, as it was named in 1953 on its opening (Redemagni 2011).[8] The historian Giovanni Paoloni has highlighted the derivation of the celebratory framework of MUST from the nationalist and identity-driven culture of fascism. In 1932, the year

7 Relations with Italy in the early years of Marconi's companies were often business-like, with a certain amount of ambiguity, see Balbi, *infra*.

8 The attribute 'della tecnica' (of technique) was changed to 'della tecnologia' (of technology) in 2000, when MUST became a private Foundation.

marking the tenth anniversary of the March on Rome, the Direzione Generale degli Italiani all'Estero (Directorate-General of Italians Abroad) published the volume *Da Leonardo a Marconi* (From Leonardo to Marconi). MUST holds a copy with the *ex-libris* of its author: Francesco Savorgnan di Brazzà, a journalist and science populariser specialised in advocating for Italian scientific achievements. The project of a 'national' science museum took shape in this context. Marconi therefore represented the other pole of a historiographical arc seen as significant for the nation's history, spanning from the Italian Renaissance genius to the scientist-inventor-entrepreneur, emblematic of the fascist era (Paoloni 2018, 13). His figure, already renowned worldwide, appeared shrouded in the same avant-garde and unconventional aura of the 'mythical' Leonardo da Vinci (Beretta, Canadelli, Giorgione 2019, 41).[9]

Marconi's direct involvement in the operation that eventually led to the musealisation of artefacts representing his enterprises is a fundamental aspect of this process. Although contemporary, in the 1930s Marconi's cultural heritage corroborated the claim for an Italian protagonism in the historical development of science and technology. The musealisation of Marconi did not end with his death, but it was actively continued in the early years of MUST by a series of successors, as recounted in various chapters of this volume. The process was characterized by a particular emphasis on the narrative of the inventor's biography.

Dots, Dashes and Other Codes

The biographical literature on Marconi from the early twentieth century, particularly during the fascist era, "presents itself […] as a chain of texts that fed into one another and adapted to different communicative and cultural contexts: a sort of *traditio*, not oral in this case, but written", observed the communication historian Peppino Ortoleva (1996, 12). The circulation of these accounts was largely the result of Marconi's own self-promotional activism, as he was highly skilled at narrating his historical role as a "great man" of science (Ellis 2016). As his most thorough biographer put it, "Marconi's greatest invention was himself" (Raboy 2016, 8).

The fascist era consolidated an intriguing but reductive vision of the historical significance of Marconi's enterprises by insisting on the invention of radio broadcasting. This was presented by fascist ideology as *the* new communication medium, emblematic of the avant-garde and propagandistic image the regime sought to project, even if in Italy it was still a niche medium in terms of users and diffusion (Paoloni 2019, 17). As we know, the communication industry based on electromagnetic waves established by Marconi was oriented toward entirely different developmental scenarios, which were much more significant in economic and geopolitical terms. Through the Marconi's Wireless Telegraph Company (MWTC), founded in 1897 in London and later expanded into a global constellation of firms,[10] the new technology offered an alternative telegraphy system – claimed to be more economical and flexible than the established but costly cable network. The MWTC operated in the profitable field of transcontinental telecommunications. With wireless systems, long-distance communication became possible even in mobility – on the sea and in the air – alongside vehicle

9 Giorgione, *infra*, explores the post-mortem iconography of Marconi.

10 Originally founded as the Wireless Telegraph and Signal Company. The name was changed in 1900 (Raboy 2016, 126).

tracking, enhancing navigation safety. For a long time, Marconi and his technicians considered the possibility offered by wireless systems to communicate to many from one point a default to correct, since their aim was to guarantee privacy and precision in telegraphic point to point communication. Marconi himself showed little interest in the initial developments of radio broadcasting, which only took off around the 1920s thanks to the contributions of ideas and individuals from other fields (Balbi 2017).

This complex historical scenario has rarely surfaced in public discourse and popular context in Italy in the second half of the twentieth century. Regarding Marconi the narrative has always matched a fixed 'legend of the inventor' well summarized by the prominent Italian historian of communication Peppino Ortoleva:

> The representation of genius as a precocious and stubborn child, fundamentally self-taught; the dramatized narrative of decisive experiments, particularly the first transmission experiment accompanied by the farmer's gunshot […]; the emphasis on the difficulties encountered, especially contemporaries' scepticism; the portrait of the inventor as a wizard, out of reach in his floating laboratory, the *Elettra* […]; the insistence, especially from the Italian side, on his superiority over inventors and scientists from other nations. In general, biographers have constructed their anecdotal narratives from authentic and demonstrable episodes in Marconi's life. However, the narrative form, the dramatization style, and the analogies with similar episodes from the lives of other inventors aimed at a precise goal: attributing an exemplary meaning to the life of the radio inventor. (Ortoleva 1996, 21, transl. by the author)

MUST had rearranged and modified the permanent exhibition on Marconi several times since 1956 – when the museum first succeeded in gathering and exhibiting a significant number of 'Marconi relics' – but proposed an equally fixed narrative. At the museum, the stages of the inventor's legend took the form of a succession of evolutionary stages of technology, leading from 'primitive' wireless telegraphy to a 'noble' application: the radio itself. [11]

The guidebook created in 1995 to mark the anniversary of the first "wireless transmission experiments", opened with this statement: "The first radio messages were not words or musical pieces but rhythmic series of dots and dashes in telegraphic transmissions" (Soresini 1995, 16, transl. by the author). Although the statement is not incorrect, it is worthy to note the emphasis given to the linear progression from a less evolved communication medium – now obsolete, like the telegraph with its primitive 'dots and dashes' – to a more evolved one, known to contemporaries as 'radio', with articulated words and music. In other words, the mythical narrative of the inventor's biography translates into an equivalent legendary interpretation of a biography of the radio as a medium. As argued by Simone Natale (2016), such narratives about the birth and development of media help shape a particular way of understanding technology and its relationship with society. This approach has shaped the MUST exhibition until today.

11 In 1956 the Sala Marconi was put in the Physics Gallery, but an important milestone at MUST was the inauguration of a permanent gallery dedicated explicitly to Telecommunications in 1975. In 1995 an exhibition was set up dedicated to the centenary of the transmission experiment of 1895. The current display of the Marconi collection dates from 2007.

Venerated Radio: A Mythical Narrative Through Historical Objects

The current display dedicated to the history of radio is part of the permanent Telecommunications gallery. A special introduction welcomes visitors: a glass case stands in the middle of the hall entrance, exhibiting a simplified reconstruction of the devices used by Marconi in 1895, at the age of twenty-one, at Villa Griffone, his family home, for his first experiment of wireless transmission over the hill nearby. This display sends us back to the Bolognese countryside and to the crucial moment of the famous gunshot fired by a farmer, signalling to the young Guglielmo the success of his early intuition.

To the right of the entrance, a long window case spans the entire wall of the room. At its beginning, it showcases a selection of Marconi’s early twentieth-century experimental and industrial devices, representing the beginnings of wireless communication. Here, through the artefacts, three celebrated milestones of Marconi’s journey are depicted: the prototype of the circuit patented with the number 7777 that gave rise to the development of tuning devices (1900); three samples of the magnetic detector, including two prototypes (1902); and an early naval wireless station that provides an excuse to mention the famous heroic episode of the sinking of the *Titanic* (1912).

Replicas and originals coexist throughout the exhibition. Criteria like the need to explain wireless functioning principles and the availability of space overcome historical authenticity. As the long display case progresses, the exhibition of Marconi’s esoteric devices seamlessly becomes a comforting array of radio receivers from various brands, increasingly familiar to contemporary visitors – from the early vacuum tube models of the 1920s to modern digital devices. This compelling visual narrative can be embraced at a glance, and it conveys a powerful spatial metaphor asserting that “Marconi invented the radio”, inevitably presenting him as the progenitor of everything that followed. Through the exhibition technique of multiplication, the radio technology becomes identified with our familiar household receiver – be it a stylish vintage cabinet or a smartphone app – which, with a simple gesture, keeps us company at home or on the go.

As the historian of technology Anna Guagnini has observed, many museum exhibits on the history of Marconi (not only at MUST) do not present artefacts and documents accounting for the productive, organisational, and large-scale infrastructural aspects of wireless technologies – such as the massive transmitting stations, with their powerful electrical equipment and gigantic antenna structures. For Marconi and his companies, these were the truly significant domains in scientific, industrial, economic, and political terms. Not only are these material aspects underrepresented, but the collective dimension of technological enterprise, which in Marconi’s case, involved huge teams of professionals, is also overlooked.[12]

However, the layout and aesthetics of the exhibition convey to the collective imagination a particular ‘truth’ on how new technology develops and is widely adopted: an exceptional individual has a brilliant insight that anticipates the future and as a consequence of this, the way we live our daily lives changes forever. In the media domain, solitary inventors grant us ‘domesticated’ devices that inform us, keep us company, and enable (or compel) us to engage in society. The networked and infrastructural dimension that deeply characterises media technologies remains physically and conceptually separate from both the aspects of invention and usage, as almost nothing separates

12 I am very grateful to Anna Guagnini for our conversations on these topics. On Marconi’s technicians, see Guagnini, *infra*.

us from the inventor's first moment of ingenuity. This approach is mirrored by a common thinking in our society of massive media consumption. Issues like industrial scale, maintenance, organisation, and the materiality of installations that enable such consumption are often treated as a separate, specialistic matter and often rendered invisible (Parks, Starosielski 2015, 6).[13] Thus, in the exhibition history of museums, an object of affection like the radio receiver, akin to a famous Renaissance painting, becomes a sort of technological Venus, whose beauty magically arises from a divine Marconian breath upon the sea foam left by the *Titanic*.[14] Paradoxically, this myth of sudden and linear genesis ends up overshadowing even the primary historical witnesses to this origin that have survived to the present day: the cultural artefacts known as 'Marconi relics' (*Cimeli marconiani*).

Marconi and His Relics

Since the 1950s, the term 'Marconi relics' at MUST has indicated a heterogeneous collection of objects differing in fabrication, geographical origin, function and authenticity. They shared only one main feature, taken for granted at the time: they were all illustrations of the inventor's ingenuity and homage to the milestones in his biography. If we search for the keyword 'Marconi' in the digital collection system that helps to manage the over 21,000 artefacts at MUST, a constellation of elements emerges, gathered over time from Italian companies of the MWTC network, state organisations like the CNR, and private citizens. These artefacts are not limited to radio equipment; they include scientific instruments, naval and aeronautical relics, medical devices, television equipment, portraits, medals, and busts. Broadly speaking, they can be categorized into three groups: components of experimental apparatus for radiotelegraphy from Marconi's early career; industrial products bearing trademarks traceable to the constellation of Marconi companies in Britain or Italy (a group extending beyond Marconi's death); and artistic and celebratory objects.

A standard question in studying collections is usually who collected what, and why. In this case, it is not possible to attribute one particular choice in collecting to a single collecting subject. Moreover, within the same category, original objects coexist with probable, or certain replicas.

If we inquire more deeply into their qualities as historical documents, these artefacts not only recount Marconi's life and achievements but also, indirectly, the cultural processes that gave them a role as civic relics honouring his memory. The 1950s inherited from past centuries a well-established tradition of collecting relics of 'saints' of science, following the model of Christian beatification, where scientists referenced a supernatural, otherworldly dimension (Conforti 2015, ix). It is interesting to note that in the late nineteenth and early twentieth centuries, the term 'relics' was used for artefacts embodying the national memories of a young Italy. These were the secular relics of Risorgimento martyrs – arms and symbols of the battles that united the country – which, in the last quarter of the nineteenth century, were gathered and displayed in high-profile events like the Temple of the Risorgimento at the Turin Exhibition of 1884. These temporary events gave rise to historical museums in various Italian cities (Cavicchioli 2022). It is likely that such events indirectly

13 MUST Telecommunications gallery proposes a very quick glimpse on infrastructure in a dedicated hall.

14 The *Titanic* 'myth within the myth' stands for the hundreds of ships – often anonymous trawlers – served for decades by the branch of the Marconi International Maritime Company, founded in Brussels in 1900, an enormous business (Raboy 2016, 145).

inspired a new type of museum meant to represent Italy in its dimension of technoscientific progress. Here, too, as in political history, an "arsenal of symbols" (Baioni 2020, 18) was necessary, simultaneously referring to the nation and technoscience.

However, the mass educational mission that the technical-scientific museum sought to achieve through the exhibition of relics differed from that of Risorgimento museums, which were oriented toward the symbolic construction of citizens' belonging to the new nation-state. Being Italian citizens was a new but permanent and long sought after condition, and national unity was a historical endpoint. The task of the national technoscientific museum, on the other hand, was to promote patriotic pride through admiration for technological progress – already perceived as advancing at a fast pace – and, on this basis, foster scientific literacy (Ucelli 1958). The origins of technoscientific museums worldwide are rooted in this widely shared programme. Since the second half of the twentieth century, this began to be perceived as increasingly problematic, because of both the obsolescence concepts and theories in scientific disciplines represented by the historical objects and the mythical history they were intended to convey (Bud 2017; Canadelli, Beretta, Ronzon 2019).

The History of Science and Its Educational Dilemmas

Since the late 1960s, the science centre model – with its hands-on exhibits and workshops encouraging a direct engagement with scientific phenomena without necessarily relying on the display of historical artefacts – has been proposed as an evolutionary stage of the traditional museum, with its precious showcases and strict 'do not touch' rules (Schiele 2014). Since then, the presence of collections in the context of technoscientific culture has placed two fundamental aspects of the museum mission in a dialectical relationship: the educational role in STEM disciplines (Science, Technology, Engineering, and Mathematics) and the task of historicising technoscience.

In her seminal ethnography of the Science Museum backstage, Sharon Macdonald observed that the new visitor-centric approach adopted by the museum along with the desire to compete for public attention in the general entertainment arena – two very well-intentioned aims – entailed a marginalisation of the museum's historical objects. Those objects were recognised as the museum's 'USP – Unique Selling Point': they were "what was distinctive about the Museum […] and made it different from other leisure or educational pursuits and from science centres" (Macdonald 2002, 247-8). But, at the same time, the key to modernising popular scientific institutions was turning away from the artefacts' centrality in the museum discourse. According to a prominent curator and historian such as Jim Bennet, the creation of the new science centre model risked indeed proposing, again, a 'pure' model of science, "a reinstatement of the unambiguous and objective" (Bennet 2005, 606). These were the same ideas that 'old' science museums promoted originally with their collections of scientific icons, but the difference was that in contemporary times objects could no longer be part of this representation, because they now

> seemed ambiguous and contingent. Insufficiently malleable to the new mission, they retained too much of their own agenda, derived in large part from their preexisting 'biographies'. Galleries full of them seemed to raise too many questions where what was wanted were answers. (Bennet 2005, 608)

Historical objects documenting earlier stages of technoscience represented outdated concepts. Moreover, they often

provided links to problematic historical phenomena – such as the excesses of industrialisation and war – which disrupted the positivist idyll between technoscience and social development (Molella 1999; Pestre 2017). The proceedings of a 1980 conference in Rome on the relationship between scientific education and the history of science give us a glimpse as to how this international debate was received in the Italian context and, specifically, at MUST.[15] On that occasion, the German pedagogist Walter Jung[16] observed that for many physics teachers – a subject "oriented toward objective and general knowledge, independent of the randomness of its actual development" – the 'real' history, with its contingencies and accidents, was even considered "disturbing" to their work (Jung 1980, 15, transl. by the author). A non-historical, orderly model of physics' diachronic development allowed them to retrospectively systematize the process and enabled students to organise their thinking. While a realistic history of physics was acknowledged as an important antidogmatic corrective, for the practical purposes of learning the subject, approaches like "pseudo-history" or "quasi-history" based on rationalized sequences of events, were ultimately more functional (16, 22).[17] These discourses were echoed by Orazio Curti, a MUST manager who reported on the museum's exhibition best practices. Curti argued that scientific heritage had only recently become part of the humanistic museum world as "an indispensable complement to written testimony". He argued that museum professionals' task was to develop effective ways of "appropriately illustrating a discipline":

> In interdisciplinary museums such as technoscientific museums, each subject gives life to a gallery […]. The museologist must consider the necessity of presenting past, present, and possible future developments of science and technology. The display should present a logical succession of interdependent discoveries, highlighting the evolution and progress based on the refinement of scientific and technological achievements over the centuries. The display […] should transcend the *special meaning of individual objects* in the name of the superior value of a general order, given to collections of real objects, documents, and reconstructions. (Curti 1980, 210-11, transl. and emphasis added by the author)

Historical objects were subordinated to science school programmes proposed by schoolbooks – as a complement to written science – and explicitly not considered in their individual and contingent nature. By abandoning their situatedness, material testimonies could be a narrative device integrated into the construction of a school-compliant history of science. This approach to museum collection was not new. George B. Goode, the first historian of science responsible for collections at the Smithsonian Institution in Washington, D.C., had proposed that "curators must learn to synthesize the study of objects with generalizations about history" (Henson 1999, 254). Consistently, in 1953, Franco Soresini (1920-2012), a scientific collaborator at MUST who curated all the editions of the telecommunication galleries (including

15 In reporting the Italian debate of the 1980s I will deliberately refer only to 'science': this field was analytically separated from technology and considered the primary field of education.

16 Jung, a pupil of H.G. Gadamer and T.W. Adorno, was director of the Institutes für Lehrerfortbildung in Frankfurt from 1961 (Wiesner et al. 2011).

17 "Quasi-history" was a label created the year before the Rome conference, by the physicists M.A.B. Whitaker, advocating a more socially aware history of science: "the quasi-history ignores the processes which needed so much time and effort, the detailed examination of the evidence, the comparing and contrasting of different lines of thought, and the construction and testing of hypothesis after hypothesis, all of which led up to the creative act" (Whitaker 1979, 240).

the current one, shortly before his death) used to define himself a museum 'organiser'[18] rather than a 'curator'.

Nowadays, educational approaches in science museums have obviously evolved well beyond the subsidiary roles to textbooks described by Jung and Curti in 1980. Yet, maybe as a consequence of those old approaches, many experts in public science communication and museum education tend to understate the presence of objects as historical entities, often deeming the 'museum model' of communicating science definitely outdated by the 'science centre model' (Spada 2022). In response to this long trend, science historians have proposed different ways to keep science history and science education in the same frame. Solutions span from incorporating historiographical investigative methods directly into the scientific research process (Maienschein, Laubichler, Loettgers 2008), to including the study of real historical processes in science education, pursuing a broader but more complex and time-consuming approach (Bernardini 1980; Heering 2017), or using historiographical literacy to enhance science communicators' skills (Liu 2024). In some measure, scepticism on the collection and exhibition of historical objects as a way to foster the popular understanding of science has never been entirely abandoned, even among historians of science themselves. Notwithstanding the discipline's 'material turn', the enormous availability of museum objects has rarely been considered as an effective starting point for enquiries into the history of science (Lüthy 2015; Alberti et al. 2024).[19]

Thus, when MUST approached a critical review of Marconi relics in 2024, the cultural scenario outlined above was suggesting that those old artefacts – like many other musealised objects of national science – risked getting caught in an impasse. On the one hand, if they looked like icons of some historical achievement, they seemed trapped in a sort of positivist nineteenth-century Arcadia, comforting and devoid of present-day tensions but self-referential and directed only at nostalgic enthusiasts. On the other hand, if they were to be read as educational examples of science, they seemed deprived of meaningful connections to the contemporary landscape.

Once Upon a Time in Technoscience: Between History and Memory

The debate on the use of technoscientific artefacts in education and academic historical research is usually not much concerned with a trivial but fundamental consideration. Although the two positions often coincide, being an object of the past and being a museum object are not the same thing. This is a meaningful difference when we seek to produce narrations of the past out of some generic artefact, compared to making the same operation out of the 'chosen' museum object. Beyond education, popularisation or academic history, museum objects also transport us into the territory of commemoration, which is at the core of this collective reflection. The enigmatic Marconian

18 'Ordinatore' in Italian. ASMUST, Corrispondenza, Corrispondenza II Serie, F. Soresini, "Pensieri sul museo", letter from F. Soresini to G. Ucelli, 30/12/1953.

19 In Italy the authoritative voice of the historian Marco Beretta stated: "The fading of the now anachronistic ideological motivations that gave birth to the science museums has in some ways limited their purpose […] Contemporary science no longer seems to need these ancient institutions. Science museums are becoming increasingly more and more expensive and inadequate compared to the speed of scientific progress" (Beretta 2022, 141, transl. by the author).

relics may be almost pointless to contemporary science communicators and difficult to interpret for those who are not historians specialized in 1900s electromagnetic devices (What exactly are those brown things? How do they work?). But it is clear – especially by their epithet 'relics' – that they take on some kind of symbolic value that is not easy to frame in the common understanding of the educational vocation and cultural mission of technoscientific museums.

Nowadays the largest national museum institutions share the assumption that they no longer should be 'just' cultural authorities displaying national treasures to the public but open and dynamic organisations hybridised with external worlds. Museums put their social mission at their core (Brown, Mairesse 2018). Italian museology shares this view: as Christillin and Greco argued, all museums today are required to satisfy the oxymoron of fulfilling their role of preserving the past while, simultaneously, innovating (2021, 27).

For science museums, however, the tension between past and innovation does not only concern the institution's mission but is deeply embedded in their own historical heritage. Collections are composed of material memories *of* innovation processes. An intrinsic and unique reference to the future characterises the collections of artefacts of the past technoscience: newness, innovation and discovery are central concepts for those who work in this field, but in museums, the passage of time and the institutional mandate of preservation unavoidably lead to the obsolescence of collections in their representativeness of these concepts. For the heritage bearers, namely the communities expressing and supporting the preservation of scientific cultural heritage (such as scientists, industrialists, technicians, and technoscience professionals) this can be problematic since good science, after all, 'forgets' outdated concepts and theories and moves forward (Boudia, Soubiran 2013). Only nostalgia as an emotional engagement seems to justify the use of historical artefacts in science dissemination contexts (Davies, Horst 2016, 174). The ratio of keeping those artefacts, therefore, is not obvious, and their very existence as 'heritage' is a matter of debate (Cotte 2023).

Musealisation places technoscience artefacts within a cultural framework that transcends its specific domain and aims at larger cultural frames. As museum artefacts, even technoscientific collections share the destiny of *any other* musealised thing. This consideration, trivial as it may sound, is quite new in Italy, where technoscientific heritage has only in recent time been officially acknowledged by the State (Canadelli, Di Lieto 2024; Morisetti, Ronzon 2024). Being 'cultural assets' for technoscientific artefacts entails the adoption of perspectives and tools from other fields in the humanities and social sciences (e.g., historiographies of other sectors, anthropology, economics, sociology). In consequence of this, these artefacts now represent something 'more' than technoscientific achievements. This leads to a decentralisation of the narratives involving them, giving space to a wider range of public discourses on technoscience, hybridised with the perspectives brought in by lay people or other kinds of experts. This long-awaited cultural acknowledgment for technoscientific collections paradoxically happens when contemporary museology heavily questions values such as 'nation', 'universality' and 'progress', i.e. the key concept that historically produced those collections (Basu 2023). This opens up further contradictions for technoscientific museums.

Thus, it is useful to reflect on anniversaries as moments permeated by all those fruitful and revealing tensions. Anniversaries not only push technoscientific museums to think beyond the dichotomy between education and history as disciplined domains, but also address the collective sense of time, which in museums is established by a specific group in favour of a larger community. Anywhere and in any kind of memory institution, this aspect prompts questions about the modes and subjectivities of who is

"reclaiming interpretive rights to their heritage" in terms of a supposed collective memory (Murphy 2005, 76). Despite their special 'presentist' attitude, museums of technoscience should not be considered immune to this larger cultural frame.

At the end of the twentieth century, the issue of collective memory was largely debated with reference to a dialectic (and conflictual) relationship between history and memory drawing on the writings of the historian Pierre Nora, who conceptualized museums and other monumental sites as *lieux de mémoire*. But technoscientific museums have not been particularly considered within this perspective. Marconi relics are a good example: they have always been treated as a positivistic account of Marconi's technoscientific production until today, without considering any of their symbolic and metaphoric values (Spada, *infra*).

In light of this, I consider it interesting to go straight back to Nora's classical argumentation as a reflective exercise and to apply it to this specific context. For the French historian, the label *lieux de mémoire* was broad enough to include both material elements and institutions (such as monuments, archives, museums, and their collections) and ritualistic and intellectual elements (such as ceremonies, speeches, and history books themselves), where material, symbolic, and functional aspects coexist. He identified as *lieux de mémoire* all entities that simultaneously embody the explicit intention to remember a past episode in an identity-driven way, by actors promoting this memory and defining themselves according to it. At the same time, those entities aim to stop time and bring that past episode into the present, resurrecting it, and attributing to it renewed meanings. In those 'places', the very same material traces are both a source of memory and history, but the latter goes in an opposite direction. History critically intervenes to distance the past, producing a 'scientific' representation that, although being aware of its relativity, aims to avoid the subjective dimension inherent in memory. Historical narrative tends to conquer spaces and uproot the spontaneous, ritualistic, and affective processes of memory. In return, through *lieux de mémoire*, the memory of individuals and groups has become a primary object of historical investigation. History and memory define each other in a dialectical tension (Nora 1989).

From the perspective of those working with historical heritage, in curation, archiving, conservation, and restoration, it is easy to recognise the tensions between 'memorising' and 'historicising' processes at play around technoscientific collections, even if those dynamics are not made explicit in the public face of the museum. From the anecdotical accounts and empirical evidence of many fieldwork experiences shared with colleagues in Italy and abroad, we can say that memory plays a great role in the inner life of the technoscientific museum, defining it as a "time machine" (Murphy 2005, 71) rather than a sole repository of material samples of scientific principles.[20] Memory provides a framework in which many people, both lay and expert, give musealised objects a particular meaning which goes beyond both academic history and STEM education. It is in the name of memory, in a quest for a sense of the past which involves affective and identity dynamics from the present, that new objects are donated to expand the museum collections, or existing collections are rediscovered and appreciated. We are speaking of artefacts of all kinds, often not 'important', more frequently mundane and for everyday use, since technoscience is everywhere: they become ways to keep alive, in the present, traces of past affective relationships, work practices, and identity values for individuals

20 Eloquent examples are presented in Boon et al. 2014; Geoghegan, Hess 2015; Geindreau et al. 2016; Haines, Woodham 2019; Casonato 2024. The doctoral thesis by Spada 2024 provides an ethnographical inquiry of these cultural dynamics at MUST with reference to the radio collections.

and communities, be they artisans, research groups, entrepreneurs, industrial employees, families, and so on. The celebration of technoscience anniversaries, blending the commemoration of individuals with material and immaterial objects – including their methods, discoveries, tools, and products – is a highly eloquent example of this dynamic (Abir-Am 1999), which in this book we actively explore in the journey that led to the collection of 'Marconi relics'.

At the very same time, the material traces of technoscience represented by musealised artefacts of any kind are increasingly part of an institutionalised system of public resources, methodically organised according to cataloguing, archival, library science, and conservation disciplines, to be accessible to anyone who wishes to use them (see Ronzon, *infra*). They are thus equated with other elements of national heritage: assets to be studied philologically and preserved professionally, aiming to advance ways to scientifically understand the past according to academic and professional historiography. This form of producing knowledge out of technoscientific artefacts is, of course, rather different from the knowledge produced in disciplinary domains of groups and individuals who sustain a shared memory of the technoscience past and often actively kept or produced artefacts to musealise them. These specific "mnemonic communities" (Zerubavel 2003, 8) are traditionally linked to the context of the technoscience museums but with a different expertise on those traces and may have different ideas about how the relationship between the traces and the past should be examined. But throughout the museum officiality, eventually, collections of technical-scientific artefacts are increasingly recognised by states and most citizens as cultural heritage *per se*, assuming a larger historical value for everyone.

This happens precisely because those thematic museums fulfil their role as *lieux de mémoire*, beyond and alongside their focus on 'communicating' current technoscience. Objects like artefacts connected to Marconi can thus be understood, broadly, as "material products of human activity that acquire high symbolic value by encapsulating some crucial representations of the community's past" (Fabietti, Matera 2018, 63, transl. by the author), regardless of which specific perspective is applied to this past.

Curating Stories: From Artefacts to Historical Sources, and Back Again

Once we reflect on the multiplicity of the relationships with the past carried on by musealised technoscientific artefacts, the question arises of interpretation and presentation to the public from the curatorial point of view. Curatorial practice is the research posture that shapes this volume: what should it be, beyond the role of 'organiser'? The scientific dimension of curatorial work is not placed within the specialist field of academia but within the public arena of museums. It relates to a plurality of stakeholders, requiring a continuous redefinition of the conceptual toolbox. In the last decades, in the ever-evolving world of museums, the term 'curator' has

acquired a certain semantic indeterminacy.[21] According to museologist Noémi Drouguet, this happens because the museum today has become "undisciplined" in two ways: on the one hand, it is called upon to engage in a creative exercise of continuous self-criticism, leading to a post-modern practice that is free and contaminated; on the other hand, it has lost its rigid alignment with the epistemological frameworks that once governed the adherence of museums to a broad range of academic disciplines, whose research they were an integral part of. Curatorship is still expected to involve deep knowledge of the museum's themes embodied in its collections, but also the challenge of considering how to present them to the public through increasingly sophisticated means that involve a wide range of expertise (Drouguet 2016). In the already interdisciplinary context of technical-scientific museums, curatorship thus finds itself caught between the risk of rigidly holding onto positions considered outdated and its dilution into less specific professional dimensions.

Sam Alberti, a prominent expert in the field, has highlighted an important dimension from which to reconsider curatorial methodologies in technoscientific museums: narration. "Ultimately, stories are our job", he wrote (Alberti 2022, 30). Seen through field experience, this statement appears less simple and obvious than it might seem. The mythical stories of great inventors, from Leonardo to Marconi, sound fascinating despite being not very accountable in historical terms – in fact, paradoxically, sometimes because they are so. One sign of their social relevance is that for museums, either entirely disregarding or rectifying these tales is often just as problematic as celebrating them uncritically as immutable mantras (Jordanova 2014). For museum curators, dealing with stories is not simply about cultivating storytelling skills, which are not exclusive to them.

The interpretive work of curation relates to a deeper narrative dimension that concerns the public representation of time. All linked to museum objects, any popular legend, personal memory, or academic historiographical reconstruction that comes to life shares the condition of being narrated. Stories prompt a view on how past, present, and future bond together.[22]

Museums are a fundamental source of stories, and this should be considered a crucial feature of their social mission, all but trivial. Thus, it is interesting to reflect on the specific place assigned to technoscientific artefacts as actors in the representations of the past activated by the mnemonic communities connected with museums. These stories aimed at being collectively relevant dialogue with both history and memory in Nora's terms.

Sociologist Eviatar Zerubavel proposed the concept of 'temporal maps' to analyse the social construction of history organisation in our individual minds. Museums are highly effective tools for the social and individual *mapping* of time. As in the nineteenth century natural history museums became a privileged site to realise and

21 A tautological definition like "someone who carries curatorial responsibilities" was suggested for the English dictionary (Horie 1986, 267). In Italy, some museum colleagues pointed out at least four meanings of 'curator', with a little irony: curators may be seen as the "backbone of the scientific staff of the museum" studying collections; "interpreter of a museum narrative" or "scholar of a period or theme" when we think of exhibition; but there are also many 'handyperson' curators, that often stand at the cash desk, guide visitors and, if necessary, sweep museum floors. The "independent curator of contemporary art", the only "true cultural guru" stands apart from all those categories (Negri, Marini 2020, 59-60, transl. by the author).

22 As narratologists observe, stories are crucial for human beings, and they are often underestimated because of their aura of innocence and lightness. There is a profound and constitutive relationship between the human condition and being caught in "webs of stories" (Schapp 2017; Gottschall 2022). Stories have been studied as fundamental phenomena that linked the cultural and biological evolution of humanity since the Neolithic (Cometa 2017).

scientifically measure the passing of time, thanks to the overall glimpse they offered on 'evolution' during ages (Bennet 2004, 21), technoscientific museums seem to offer the same possibility but with a view to 'progress'. Here galleries can spatially represent time by defining sequences of historical artefacts that create the illusion of walking through eras. Through cataloguing and dating artefacts, technoscientific museums establish chronologies and anchor points that become shared ways of reading eras. If we reconsider the narrative logic of the history of radio proposed by MUST and analysed above, we see that it corresponds to a specific type of linear mapping forward, communicating the idea that the course of history is a progressive ascent to higher stages of civilisation, linked to superior technology.[23] The mythological simplification that portrays Marconi as the inventor of radio continues to persist and in popular accounts it has often been updated to mobile phones and smartphones. This relation with the past, used to explain and justify the present state of affairs of telecommunications dominant actors, was established precisely by emerging industrial actors in this field, such as Samuel Morse, Alexander G. Bell, and Marconi himself. These entrepreneurs were devoted to a 'usable' notion of past for self-promotion and fostered the habit of identifying historical periods with specific technical artefacts: the era of the telegraph, of radio, and so on (John 2023, 320). Throughout the twentieth century big industrial players in the ICT, such as IBM (or Olivetti, if we consider Italy) were active in donating historical artefacts to museums or even building them for that purpose (Hénin, Casonato 2020; Casonato 2025). This practice has been carried on in our age, when large tech companies resort to a "corporational determinism" attitude, being active in proposing a linear view of the past that provide justification to their dominance, as the result of an inevitable historical process (Natale, Bory, Balbi 2019).

The chronological display of the dozens of radio receivers aligned the MUST telecommunication gallery, matching decades with technological advancements (crystals, valves, transistors, chips), and carries the latent message that the historical testimony value of those artefacts lies in their ability to speak about the 'duty' of technoscience to guide humanity from a less evolved past to a better future. This approach reinforces an idea of technology that is reified as a monolithic, homogeneous historical agent (Marx 2010, 982). Each receiver here does not testify its situated historical vicissitudes, but is rather a representative of a larger, almost Platonic, entity: *the* radio, or even more broadly, *telecommunications*. Visitors are not introduced to that particular artefact, but to the larger entity that it iconises. This is what is offered to visitors' temporal mapping processes. Symbolically, each receiver belonging to this taxonomy is virtually interchangeable with another of the same 'family'.

This linear conception of a progressive 'mediatisation' or technologisation of the communication has been long debated by historians in this field. Of course, contemporary historians of media pointed out the fallacies of deterministic views of media development. On the one hand, the habit of describing recent phenomena in relation to what preceded them, rather than following their own documented developments (as in the case of wireless telegraphy seen as the obvious predecessor of radio) leads to anachronism and risks pushing historians to a continuous updating of their theories to the latest innovation. On the other hand, there is the risk of overlooking how the history of communicative practices was not always directly related to the progressive expansion and

23 Despite being widespread, linearity is just one of the ways that humans have of mapping time, as a cultural legacy of the Enlightenment (Zerubavel 2003).

availability of media technologies throughout ages (see, for instance, John 2023; Bourdon, Balbi 2021).

If each object of the gallery is approached according to the philological attention that professional historians should devote to documents, its narrative role as museum artefact assumes a different meaning. Museums indeed preserve *literally* unique objects, indicated by the inventory numbers, that have been deliberately constructed as collection artefacts. This is true even for samples of nature, like stones, although they are perceived as raw and spontaneous when exhibited.[24] As well, in technoscientific museums the process of extrapolating artefacts from their original context for exhibition purposes, for example a laboratory instrument, involves choices of representation that 'freeze' functioning artefacts and may recall taxidermy practices used in natural history (Casonato 2024, 174). Museum objects of any kind are the result of a historically situated process that involves extracting a material sample from the broader fabric of reality, recontextualizing it within the museum apparatus and using it to produce what we name 'culture' and 'knowledge' (Pearce 2012).[25]

Considering objects as individual material entities with their own identity opens up a field of diversified stories that have the chance to disentangle the knot of reified technology. The well-known biographical approach to the study of things (Kopytoff 1986) is especially effective if we consider the openness to different interpretations that the special position of museum object entails (Silverstone 1992, 35; Alberti 2005).

In sum, narrations around objects can be generated by scientific historiography or inspired by symbolic values. Often, they are both. Material traces have always had a special affective role inside the scientific communities: neither science nor rationalism have managed to overcome the veneration with which the 'saints of science' have been commemorated through their relics (Conforti 2015, vii). The technoscientific museum's linear and deterministic mapping of time related to media history spreads out of the instances of a specific mnemonic community, and it becomes prone to be revised according to professional historians' terms. The nexus between museum artefacts and representation of time then is the result of different influence fields: teleological industrial narratives, mythological veneration for a pantheon of technoscientific heroes driven by collective memory impulses, and a law-compliant philological approach to heritage, informed by contemporary humanities.

Collections thus enable a constant back-and-forth dialogue between mythical construction and historiographical reconstruction, which has its own cultural dignity. It is revealed in the form of narrations that take different shapes: visual displays as well as collection nuclei, or even single artefacts (see Spada, *infra*). This is a particularly interesting area of investigation for curatorship in technoscientific museums, and for formal and informal knowledge and disciplines that cross-participate in them. Contemporary curatorial research is indeed continuously called to draw the coordinates of this dialogue and to critically discuss it.

As we will see in the following chapters, this approach especially fits in with Marconi relics. Their status as testimonies to a mythical vision of technoscience which initially motivated their musealisation does not preclude them from later becoming sources for critical and detached historical investigation, and vice versa. Indeed, the historical

24 Their existence as collection samples depends on interactions between scientific theories, organisational choices, research opportunities and even the availability of a natural site to be collected and transformed into samples (Chalk 2012).

25 I am grateful to my colleagues Francesca Olivini and Laura Ronzon for their reflections on this point. See also Chard-Cooper, *infra*, on the status of truth and unicity of objects in technical-scientific museums.

artefacts presented in this book are implicated in diverse, legitimate, and coexisting representations of the past that while they help sustain the memory of the inventor call upon for further historiographical explorations. The museum can be read as a platform that allows all these operations.

Ultimately, this book focuses on ‘past stories about the past of wireless and its imagined future’ that we can explore thanks to musealised artefacts. This may sound like a departure from the primary mission of technoscientific museums. But from field work experience we witness that fascination and care for mnemonic elements embodied in special objects of past technoscience, unexpected encounters with them, efforts to understand them as cultural traces of other eras, developing and reinterpreting stories based on them, all those activities deeply stimulate curiosity and a critical approach to the world: essential ingredients to foster a scientific mindset, in harmony with the contemporary mission of these institutions.

Francesco Savorgnan di Brazzà, *Da Leonardo a Marconi*.
Popular science volume on the achievements of Italian science, published by Direzione generale degli italiani all'estero. 1932.
Biblioteca Museo Nazionale Scienza e Tecnologia Leonardo da Vinci

The Contents of the Volume

The book was written by scholars with a humanistic background, who have particular familiarity with the traces of the past of technoscience, albeit according to different perspectives: history, curatorship, archives, and conservation. At the centre of their interests are science, technology and industry, intertwining this horizon with those of the media, art, society and cultural heritage.[26]

The common theme of the essays is to explore which examples of research, and which questions can arise from taking the musealised material traces of Guglielmo Marconi's story as starting point. Different perspectives emerge, collateral stories often overshadowed by the monumental projection of the statuesque figure of the technoscientific hero and by the need, often taken for granted, to recount his individual deeds as a form of commemoration. This operation brings Marconi's biography to the forefront again, in other ways, but this time in relation to those 'technological remains'.

In the first chapter, Simona Casonato and Roberta Spada present the perspective of curatorship and STS in reconstructing the formation of the nucleus of the 'Marconi relics' of MUST between the 1920s and the 1950s. Here emerge the negotiations of meanings and the interweaving of relationships between different mnemonic communities that elect themselves as bearers of the inventor's cultural heritage. The chapter is also an opportunity to reflect on curators' professional tools, such as catalogues and captions, and on their epistemic value.

Roberta Spada continues the analysis by delving into the biography of a museum highlight , which has always been considered the most important and significant of the Marconi relics at MUST: the magnetic detector built in a cigar box. Replicated in several copies, a true monument that Marconi erected to himself, it is to be found in various Italian exhibitions and collections. This artefact, taken into consideration in its material dimension, turns out to be the most representative in the mythical (self) construction of a legend of the inventor.

Anna Guagnini shows how, starting from the precise observation of the material characteristics of actual Marconian fragments, the history of electromagnetism and wireless technologies can expand into the examination of a variety of protagonists and themes that do not emerge spontaneously from a narrative exclusively focused on Marconi's biography. The examination of jiggers, components of the first radiotelegraphic circuits, brings to light the role played by Marconi's collaborators in the experimental activity that led to the development of wireless telegraphy. This raises important questions such as the role of tacit and embodied knowledge, and the joint contribution of formal and informal skills in technoscientific development.

Gabriele Balbi's essay is linked to another form of museum heritage: a document preserved in the Biblioteca Museo Nazionale Scienza e Tecnologia Leonardo da Vinci. It is the starting point that allows us to think of the influence of relationships between companies and governments in media history. The chapter is an expansion of a previous study based on the MTWC papers preserved at the Bodleian Libraries in Oxford. Balbi explores the relationship of power that Marconi exercised on the Italian government and the special position that Italy

26 The authors' institutional context shows some diversity as well. Four of the authors are academic researchers: Gabriele Balbi, Anna Guagnini and Giovanni Paoloni have benefited from the Byrne Bussey Marconi Fellowships awarded by the Bodleian Libraries, Oxford, respectively in 2012, 2015 and 2019; Roberta Spada has been awarded in 2025 the same fellowship. The other authors Claudio Giorgione, Giovanni Pietrangeli, Laura Ronzon, Sarah Chard-Cooper, and the volume editor Simona Casonato, are museum-based researchers.

occupied in the international scene of the early regulation of telecommunications, observing the theme of the national scientific hero in a different light.

Giovanni Pietrangeli highlights how the archival heritage of MUST, often the residual fruit of the relationship between the museum and dominant subjects in the technoscientific field, is a precious trace for investigating the history of industry. The author briefly returns to the story of the Marconi relics to observe how the negotiation around the collection of artefacts at MUST has left in the museum archives elements relevant to reconstructing the industrial history, paradoxically neglected until now, of the Italian subsidiaries of the Marconi companies and affiliated entities: Marconi Italiana, Società Italiana Radio Marittima, Officine Radiotelegrafiche Marconi.

Finally, Claudio Giorgione takes the path of art curation in the context of the technical-scientific museum. Starting from the copy of the bust of Marconi made by the sculptor Vincenzo Jerace, which completed the first exhibition of Marconi memorabilia at MUST, he ventures into the exploration of the iconography of the inventor and shows the synergic role of the figurative arts in the construction of the legend of the inventor and the imaginary of the origins of radio and telecommunications in Italy.

These essays are followed by an appendix with three methodological contributions that allow us to refine the toolbox available to historians and curators. Giovanni Paoloni, moving between the history of science and cultural heritage disciplines, outlines the conceptual and legal contours that circumscribe the idea of technoscientific cultural heritage in Italy. The inseparability of the different types of heritage that he highlights (such as objects, documents, books, monuments, landscapes) is made tangible by the focus on the Marconi collections.

Laura Ronzon emphasises the need for updated historiographical research on the Museum and its collections that moves from the forms of documentation built and stratified over time (such as inventories and catalogues). Retracing the main stages of the definition of these practices in the specific context of scientific and technological heritage, she raises the question of the epistemological value of the catalogue, called on the one hand, to share the state of the art in terms of knowledge on a certain artefact and, on the other, to constantly update itself.

Finally, Sarah Chard-Cooper completes the appendix with a reflection that takes us into the field, sharing with readers the 'daily bread' of the intellectual and practical work of museum people: the question of the status of 'truth' of the artefacts we handle. The author proposes a reasoned succession of doubts, questions and queries on the nature of what, in effect, we are contemplating every time we come into contact with collections. The search for answers is a never-ending job, which constitutes the essence of the cultural and scientific production of these institutions.

The investigation into the technological history of media through the philological and precise exploration of the MUST collections is configured as a new research field, in which there is still much to explore. This volume aspires to provide a first, partial starting point. Obviously this is not the case of the authoritative work of the authors involved, to whom, indeed, I owe, in addition to gratitude, much of the material on which the reflections of the introduction are elaborated. I am rather referring to the general framework that aggregates and puts their works into dialogue, which is my responsibility as the curator. To put this approach to the test of further developments, two iconographic inserts are inserted in the volume. They present artefacts and documents of MUST whose biographies are still largely to be discovered and which we hope can be the object of interest and curiosity of the many interlocutors with whom the museum sets daily dialogues.

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Replica of a ‘Righi oscillator’, or four-sphere spark gap, Marconi’s Wireless Telegraph Company Ltd., 1932, inv. D-000030

The spark gap is a device that, when connected to an electrical power supply, discharges sparks into the space, or ‘gap’, between the brass spheres that are mounted on insulated supports made of wood and ebonite. The sparks generate electromagnetic waves which can be received by a detector. The name ‘spark gap’ (Fleming 2015) was sometimes literally translated as ‘intervallo di scintilla’ or ‘scintillatore’ in Italian (Simion 1927). Several historical sources describe this device as a fundamental component of the first wireless transmitters assembled by Guglielmo Marconi from 1895 onwards. It features in many photographs and illustrations. These materials, often written for educational purposes, are widely available in the Museo Nazionale Scienza e Tecnologia (MUST) library. The name ‘Righi oscillator’ refers to Augusto Righi: the Italian physicist had already used a very similar spark gap in his laboratory where Marconi visited him while developing his first experiments. Righi wrapped the two central spheres with parchment into which he poured oil, thus obtaining a better control of the insulation (Cinti 1933, 9). Marconi adapted the Righi oscillator for his own purposes while developing radio telegraphy, modifying Righi’s experimental high-frequency “quasi-optical” instruments: he added two small dipole radiators (small antennas with two terminals) to both sides of Righi’s oscillator, significantly extending the length of the waves emitted (Hong 2001, 19). In 1955, at the request of Guido Ucelli, the Società Italiana Radio Marittima (SIRM) of Rome, a satellite company within network of Italian Marconi-related agencies, donated this replica, dating back to 1932 and bearing the logo of Marconi’s Wireless Telegraph Company Ltd, to the Museum, along with many other Marconi relics.

The Righi Oscillator. The ‘Marconi Relics’ in the Museum Collections

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At MUST, the objects collected over time to commemorate Guglielmo Marconi’s work have traditionally been referred to as ‘Marconi relics’. Most of them are displayed in an area dedicated to the inventor within the permanent Telecommunications gallery. Others are housed in the museum store and kept for study purposes.

The process of gathering material for the planned national museum collections reached a pivotal moment in the 1930s when Marconi became involved in the establishment of the museum institution. It is well known that science and technology museums worldwide took shape in close connection with the major international exhibitions organized between the nineteenth and twentieth centuries. MUST is no exception. The first collection hubs deriving from the relationship with the 1933 Chicago World’s Fair, and the role of the CNR (National Research Council), which at that time was chaired by Marconi, are well documented (Paoloni, Reali, Ronzon 2018).

However, the link between Marconi as ‘cultural ambassador’, and the collections dedicated to him, has still not been fully explored. A museum was a place that was especially suited to forms of self-representation that allowed Marconi to appear as a history-maker, consistent with his characteristic attention to the construction of his own image.[1] Understanding how collections assigned to this specific task were formed – by assembling objects from diverse sources – is not only a geographical journey, but also a search for meaning: it enables us to

This chapter is the result of total collaboration between the authors, and the order of names is purely alphabetical. Simona Casonato worked primarily on the drafting of the first and fourth sections, while Roberta Spada focused on the second and third sections. The overall framework and conclusions are the joint work of both authors.

1 See introduction, *infra*.

understand when and how the artefacts arrived at the Museum, and, most importantly, their purpose and use. These are visions that, as we will see, were not always consistent.

1 Objects and Information

The profile of the MUST 'Marconi relics' collection is unclear. Long taken for granted within the institution's history, details about the origins of this group and the criteria used to create it have blurred over time. Curating involves inheriting collections and interpretive frameworks from previous curators, which are then reformulated when new rationales or information arise, prompting their re-evaluation and reinterpretation. However, in the past, science and technology museums did not place great importance on the philological accuracy of data associated with museum objects. Managerial and operational aspects took precedence, and legal constraints were less stringent than they are today (Canadelli 2019).

The first artefact we find in the exhibition area (inv. IGB-9718), for example, is a well-known component of the early wireless transmitters assembled by Guglielmo Marconi from 1895 onwards. In MUST's inventory records, it is listed as a 'Righi four-sphere oscillator', donated by the CNR (National Research Council) in 1953. A second, identical object (D-30), apparently in even better condition, is part of the Museum's study collections and is catalogued as a 'spark gap'. It was donated to the Museum in 1955 by the Società Italiana Radio Marittima (SIRM) of Rome. Both are marked as having been built by the 'Marconi Company', with the source attributed to the English parent company, although this is indicated with an abbreviation. Despite not being one of his inventions, as was implied by the initial designation,[2] this type of object represents the experimental beginnings of Marconi's career in numerous exhibitions and illustrations. The dating, noted in the museum records as spanning from 1897 – the year Marconi's Wireless Telegraph Company Ltd. was founded – to 1933, the year of the Chicago World's Fair, raises a question about their 'origin' **[figs 1a-b]**.

This uncertainty should not surprise us. Traditionally, in the eyes of the scientific museum community, consistent naming and dating, referring to what the object 'says' on a historical level, are less relevant compared to what the object can 'do'. In other words, what the object can bring to light in relation to the theory and practice of contemporary sciences, as we will also see in the case of Marconi relics.

However, from the perspective of cultural heritage, things work in a different way. From a museological standpoint, two objects with different inventory numbers, even if identical, are considered two distinct articles, each with its own provenance.[3] The compilation and editing of a catalogue entry requires the museum to account for discrepancies, such as those that arise from their comparison. Are they originals or copies? Which of the two names – both correct, but not entirely equivalent from a historical perspective – is it better to use? Why is there such a broad dating range? Towards which reconstruction of Marconian events do the different origins of the objects lead us?

2 A four-sphere oscillator, even if slightly different, had already featured in the first famous journalistic photo of Marconi published in London by *Strand Magazine* (Raboy 2016, 81).

3 For an overview of reflections on the concept see Volonté 2009; Christillin, Greco 2021, 93-5; Spada, *infra*.

Figures 1a-b On the left, the model of the Righi oscillator donated by the CNR in 1953 (inv. IGB-9718). In contrast to its replica, it is missing some parchment. On the right, an aspect which is identical on both objects: brass disks on the base bearing the full name of the parent company

In all the leading museums in the field, in the development of science and technology heritage, these detailed criteria which were based on scientific literature, historiographical analysis or on archival standards, such as the evaluation of the producer and of the archival bond (the logical connection that links the pieces in a collection), were not considered fundamental. Priority was given to abstract, taxonomic and encyclopaedic criteria, with little attention paid to the historical accuracy of the artefact on display (Collins 2017, 40-8). As pointed out by Tim Boon, "the creation and development of collections is a profoundly idiosyncratic matter, very much contingent on the opportunities that arise to collect, and our antecedents' beliefs, expertise and enthusiasms that interacted with those opportunities" (Boon 2023).[4]

The uncertainty of the terminology and of the chronological limitations that define the 'Marconi relics' is nonetheless interesting from a cultural history perspective. It compels us to explore the origins and rationales behind the public representation of wireless communication as a scientific and educational fact, at a time when it was still relatively new. Marconi died in 1937, shortly after contributing to trigger a chain of events which would lead to the foundation of the Museum. Who took charge of curating his cultural heritage in Italy? Which principles were followed, and what remains of this process today?

4 On the subject, see also Paoloni, *infra*.

2 Institutions and Curators

In 1950, three years before the official opening of MUST, the exhibits displayed in Chicago and later in the new CNR headquarters were sent to Milan, "except for the Marconi relics which were appropriately placed in the auditorium [of the CNR] named after the great inventor" (transl. by the authors).[5]

Thus, despite MUST being an ideal place to assemble the national legacy of science, the figure of Marconi remained tied to the history of another great Italian scientific institution, which understandably felt entitled to keep the material mementos of its late, illustrious president.

Archival records show that Guido Ucelli, the founder and president of the Museum, did not give up easily. Marconi was a key component of the commemorative scientific 'pantheon' that Ucelli intended to honour (Redemagni 2011, 152). In 1951 he submitted a request to the CNR asking that the Marconi relics be brought together in Milan. The CNR however replied that there was a plan to "create a Marconian museum in Sasso Marconi", adding that "in this instance the possibility of duplicating some 'documentation' for the Museum"[6] could be considered.

At the time it was widely accepted that a copy could be an equally valid form of 'documentation' for a museum. Marconi was of the same opinion. He wrote to Ucelli in 1931:

> The Board [of the CNR] has no intention of depriving cities and Institutions of the artefacts that they painstakingly preserve and in which they take great pride. It is often sufficient for the Museum to house copies of the artefacts; I state this immediately to avoid unsubstantiated concerns, although it would of course be better to have the originals. Of utmost importance for the development of the Museum, is the documentation of scientific and industrial achievements using documents, prints, patents, photographs, artefacts, models, machines, manufactured products etc., and especially anything that highlights Italy's participation in global technological progress. (transl. by the authors)[7]

In the following decades, Ucelli diligently set about organising the collection, having widely researched the methods used by institutions in other countries. Records of his interaction with Marconi on this matter began when Marconi invited Ucelli to Rome for an "exchange of ideas regarding a science museum" in February 1931, later going on to advocate for the project at Milan City Hall.[8]

The following year, Ucelli's project coincided with Italy's upcoming involvement in the Chicago World's Fair. The opportunity stimulated an increase in the production of replicated and reconstructed artefacts intended to document Italian genius, both at the fair and in the leading museums around the world. Marconi wrote to Ucelli on behalf of Mussolini:

> His Excellency the Head of Government has decided that Italy will participate in the Chicago World's Fair

5 ASMUST, Corrispondenza I serie, 783, Consiglio Nazionale Ricerche (3), "Estratto dal verbale n. 277 della riunione della Giunta Amministrativa", 26/05/1950.

6 ASMUST, Corrispondenza I serie, 783, Consiglio Nazionale Ricerche (3), 20/11/1951.

7 ASMUST, Corrispondenza I serie, 783, CNR, letter from G. Marconi to G. Ucelli, 17/03/1931.

8 ASMUST, Allestimento sezioni museali, Telecomunicazioni, Cimeli Marconiani e Sala Marconi, telegram from G. Marconi to G. Ucelli, 14/02/1931; letter from G. Marconi to the Podestà di Milano, 17/03/1931.

> with a collection of replica artefacts and documents to serve as evidence of the magnitude of our country's contribution to the scientific and technological progress of humanity. The collection will subsequently be moved to the American Museum of Science in Chicago. Taking advantage of the preparatory work necessary to set up this exhibition series, His Excellency the Head of Government has ordered that not one but four collections be prepared, one of which will be kept in Italy, one assigned to the London Science Museum and the other to the Munich Science Museum. (transl. by the authors)[9]

The American exhibition, which traced the origins of Italian innovation back to ancient Rome, also included accounts of Marconi's work.[10]

In spite of this preparation, on the eve of its opening in the 1950s, MUST ironically risked being deprived of the very heritage linked to Marconi. In 1953 Ucelli therefore changed his approach and instead turned to the Italian company Marconi Italiana S.p.A., in an attempt to obtain Marconi-related objects similar to those retained by the CNR.[11]

The next two years saw a long series of negotiations involving the Museum, Managing Director of the Marconi Italiana, Rodolfo Raoul Chiodelli, and CNR representatives. Engineer Franco Soresini, a young advisor of Ucelli's, also participated in the discussions, informally taking on a role (often without a salary) that today would be defined as curatorial.[12] From these letters we can infer that the CNR artefacts were initially owned by the Marconi companies and then donated to the CNR, apart from some artefacts that were "religiously" preserved at the Italian company headquarters (apparently part of the scientific apparatus used aboard the yacht *Elettra*).[13] From time to time, exhibitions of Marconi relics appeared at Marconi stands during commercial events, such as the 19th National Radio and Television Exhibition held in Milan in September 1953 or the Levante Trade Fair held in Bari in 1954. In the autumn Chiodelli confirmed that, subject to the consent of Marconi's son, Marquis Giulio,[14] the artefacts could be housed at the Museum "displayed

9 MUST, Archivio Museo industriale (AMI), Exhibitions, Chicago World's Fair 1933, letter from G. Marconi to G. Ucelli, 14/10/1932. During the preparation of this volume, the presence of objects pertaining to these sets was effectively established, not only at MUST, but also at the Griffin Museum of Science and Industry in Chicago and the History of Science Museum in Oxford (Casonato, personal message). Identical labels on the artefacts and the notes in the inventory records are consistent with this source.

10 These were displayed in a dedicated section: Masina 2016, 263; Spada Potenziani (1933?). On page 32 in the latter publication, a photograph shows Marconi standing in front of the display cases of a "Marconi Exhibit", as indicated by an inscription above them. The photograph is captioned "S.E. Marconi in the Science Exhibition Hall".

11 ASMUST, Allestimenti sezioni museali, Telecomunicazioni, Cimeli Marconiani e Sala Marconi, letter from G. Ucelli to Marconi Italiana S.p.A., 05/10/1953.

12 The extensive correspondence that Engineer Soresini maintained for several decades with Ucelli and the other members of the Museum includes proposals for acquisitions, recommendations for the exhibition of objects and various communications relating to contents, evaluations of artefacts, historical research and interactions with promoters, contributors, and other museums. ASMUST, Corrispondenza II Serie, 228 Soresini.

13 As written in ASMUST, Allestimenti sezioni museali, Telecomunicazioni, Cimeli Marconiani e Sala Marconi, l, letter from R. Chiodelli to G. Ucelli, 29/10/1953; letter from F. Rolla to G. Ucelli, 04/05/1954. We can infer from their exchange that the two had been friends for some time. Chiodelli, a pivotal but little-known figure in the history of Italian telecommunications, also served as Director General of EIAR from 1929 to 1943. See Petrangeli, *infra*.

14 ASMUST, Corrispondenza II Serie, 228 Soresini, handwritten note, 11/09/1954; ASMUST, Allestimenti sezioni museali, Cimeli Marconiani e Sala Marconi, promemoria del 12/09/1954.

in a designated area", on the condition that the Marconi companies would be able to request them at any time for celebratory events.[15] In the meantime, Soresini was continuing to develop the Museum's collection in various areas. He wrote to Ucelli in December advocating the need to replicate or reconstruct "artefacts and antique devices in order to eliminate serious omissions in the collections on display". However, he did not consider the CNR reconstructions of documentation of Italian scientific breakthroughs to be good examples:

> Not one device is consistent with the original. These reconstructions replicate only the exterior aspect and should not therefore be exhibited when a certain seriousness is required. Please find attached a list of the items that should be reconstructed most urgently, which I myself could personally oversee with all the love and enthusiasm that I have for this type of relic.[16]

According to his curatorial criteria, not only was it important to replicate precisely every detail, but also to guarantee potentially functioning objects. The vision of the artefacts is that of technology-in-use, in other words artefacts characterized by means of a specific purpose (Suchman 1999; Bruni 2020). More than mere evidence of a historic moment, it was essential that through the artefact the museum displayed the technological principle that had motivated its existence.[17] With regard to the Marconi relics, this view eventually had to deal with other circumstances that influenced their fate and purposes.

3 Negotiations and Odysseys

A group of objects finally arrived in Milan at the end of March 1955, annotated with captions and labels citing SIRM as their point of origin **[figs 2a-b]**.

It is interesting to note that Chiodelli now appears as an administrator of this satellite company within the Marconi network, but information on its origins and relationship with the parent company remains unclear.[18] One month later, the paralysis at CNR was resolved, thanks to the intervention of Franco Rolla, the new Secretary General of the institution, who wrote to Ucelli to put together something that he himself referred to as "a little conspiracy". He suggested that Ucelli write to the then-president of the CNR Gustavo Colonnetti asking that "some important artefacts, as well as an optimal reconstruction of objects from the ship *Elettra*" be brought to Milan. Rolla would undertake to request the authorisation of the Ministry of Post and Telecommunications, which owned some of the artefacts.[19] In the subsequent interactions between Rolla and Ucelli, a clear vision for the destiny of these objects emerged, which Ucelli wrote in a letter to Colonnetti on 9 May:

> It is well known that this Museum aspires to […] highlight and document the contributions to the civil and

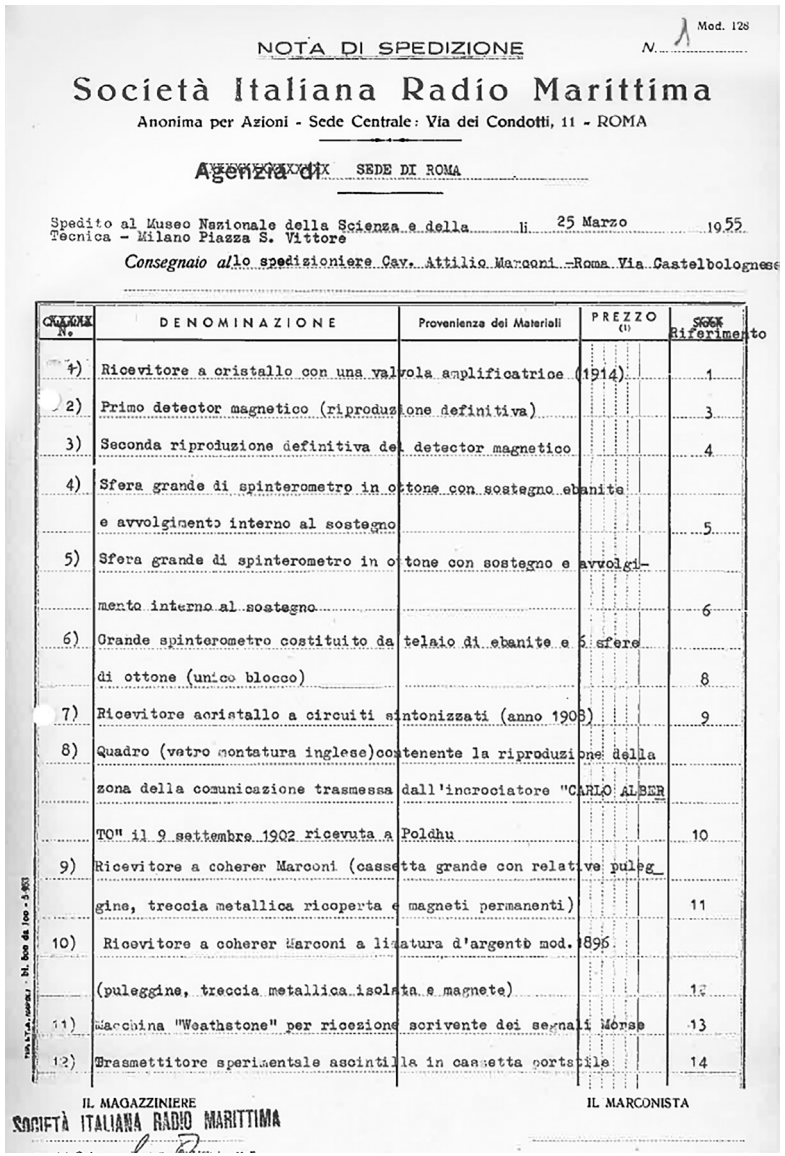
15 ASMUST, Allestimenti sezioni museali, Cimeli Marconiani e Sala Marconi, letter from Chiodelli to G. Ucelli, 13/12/1954.

16 ASMUST, Corrispondenza II Serie, 228 Soresini, letter to G. Ucelli, 16/12/1954.

17 ASMUST, Corrispondenza II Serie, 228 Soresini, letter to G. Ucelli, 16/12/1954.

18 ASMUST, Allestimento sezioni museali, Telecomunicazioni, 1324 Cimeli Marconiani e Sala Marconi, letters from R. Chiodelli to G. Ucelli, March 1955.

19 ASMUST, Corrispondenza II Serie, 909 Consiglio Nazionale delle Ricerche (2), b, Cimeli Marconiani, letter from F. Rolla to G. Ucelli, 28/04/1955.



NOTA DI SPEDIZIONE N. 1 Mod. 128

Società Italiana Radio Marittima

Anonima per Azioni - Sede Centrale: Via dei Condotti, 11 - ROMA

Agenzia di SEDE DI ROMA

Spedito al Museo Nazionale della Scienza e della Tecnica - Milano Piazza S. Vittore li 25 Marzo 1955

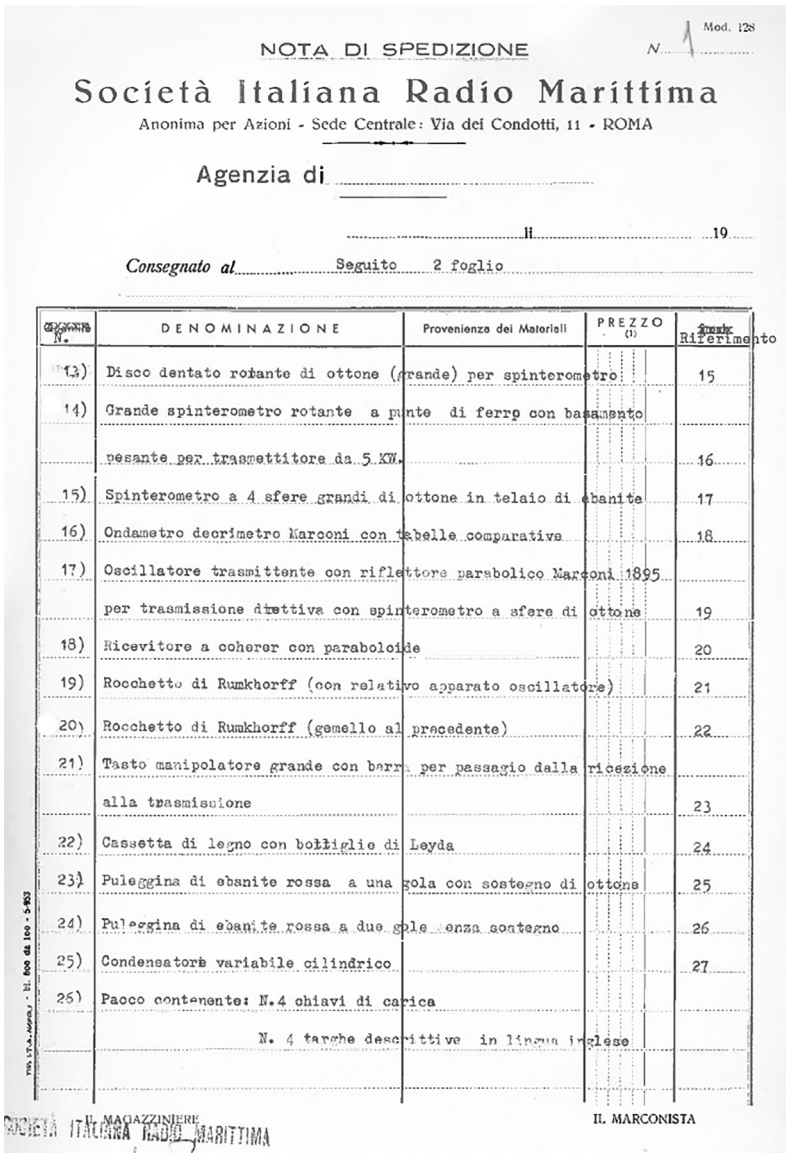
Consegnato al lo spedizioniere Cav. Attilio Marconi - Roma Via Castelbolognese

Quantità N.	DENOMINAZIONE	Provenienza dei Materiali	PREZZO (1)	Riferimento
1)	Ricevitore a cristallo con una valvola amplificatrice (1914)			1
2)	Primo detector magnetico (riproduzione definitiva)			3
3)	Seconda riproduzione definitiva del detector magnetico			4
4)	Sfera grande di spinterometro in ottone con sostegno ebanite e avvolgimento interno al sostegno			5
5)	Sfera grande di spinterometro in ottone con sostegno e avvolgimento interno al sostegno			6
6)	Grande spinterometro costituito da telaio di ebanite e 6 sfere di ottone (unico blocco)			8
7)	Ricevitore acristallo a circuiti sintonizzati (anno 1908)			9
8)	Quadro (vetro montatura inglese) contenente la riproduzione della zona della comunicazione trasmessa dall'incrociatore "CARLO ALBERTO" il 9 settembre 1902 ricevuta a Poldhu			10
9)	Ricevitore a coherer Marconi (cassetta grande con relative puleggine, treccia metallica ricoperta e magneti permanenti)			11
10)	Ricevitore a coherer Marconi a lisatura d'argento mod. 1896 (puleggine, treccia metallica isolata e magnete)			12
11)	Macchina "Weathstone" per ricezione scrivente dei segnali Morse			13
12)	Trasmettitore sperimentale ascintilla in cassetta portatile			14

IL MAGAZZINIERE

SOCIETÀ ITALIANA RADIO MARITTIMA

IL MARCONISTA



NOTA DI SPEDIZIONE N. 1 Mod. 128

Società Italiana Radio Marittima

Anonima per Azioni - Sede Centrale: Via dei Condotti, 11 - ROMA

Agenzia di

li 19

Consegnato al Seguito 2 foglio

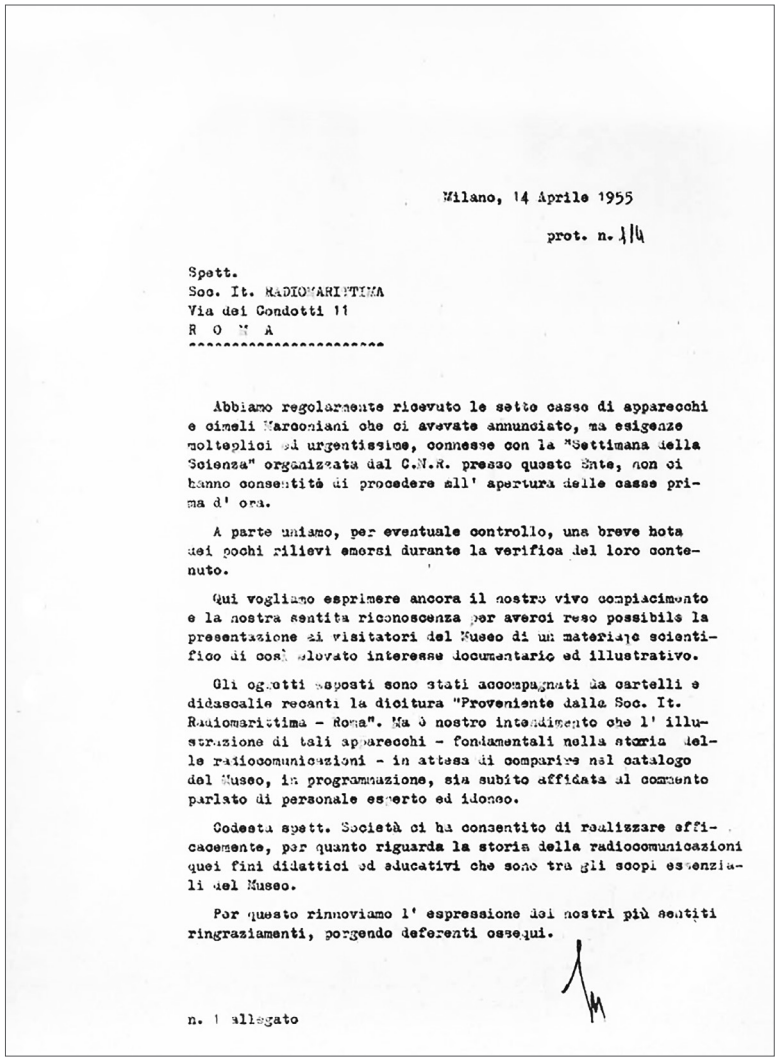
Quantità N.	DENOMINAZIONE	Provenienza dei Materiali	PREZZO (1)	Riferimento
13)	Disco dentato rotante di ottone (grande) per spinterometro			15
14)	Grande spinterometro rotante a punte di ferro con basamento pesante per trasmettitore da 5 KW.			16
15)	Spinterometro a 4 sfere grandi di ottone in telaio di ebanite			17
16)	Ondametro decrimetro Marconi con tabelle comparative			18
17)	Oscillatore trasmittente con riflettore parabolico Marconi 1895 per trasmissione direttiva con spinterometro a sfere di ottone			19
18)	Ricevitore a coherer con paraboloide			20
19)	Rocchetto di Rumkhorff (con relativo apparato oscillatore)			21
20)	Rocchetto di Rumkhorff (gemello al precedente)			22
21)	Tasto manipolatore grande con barra per passagio dalla ricezione alla trasmissione			23
22)	Cassetta di legno con bottiglio di Leyda			24
23)	Puleggina di ebanite rossa a una gola con sostegno di ottone			25
24)	Puleggina di ebanite rossa a due gole enza sostegno			26
25)	Condensatore variabile cilindrico			27
26)	Pacco contenente: N.4 chiavi di carica N. 4 targhe descrittive in lingua inglese			

IL MAGAZZINIERE

SOCIETÀ ITALIANA RADIO MARITTIMA

IL MARCONISTA

Figures 2a-b Shipping docket for Marconi relics from SIRM to MUST, 25/03/1955. ASMUST, Allestimento sezioni museali, Telecomunicazioni, 1324 Cimeli Marconiani e Sala Marconi. The spark gap is listed as no. 17 on sheet 2. We were able to verify the identity of this copy from the paper label bearing this number that was still glued to the object



Milano, 14 Aprile 1955

prot. n. 1/14

Spett.
Soc. It. RADIOMARITTIMA
Via dei Condotti 11
R O M A

Abbiamo regolarmente ricevuto le sette casse di apparecchi e cimeli Marconiani che ci avevate annunciato, ma esigenze molteplici ed urgentissime, connesse con la "Settimana della Scienza" organizzata dal C.N.R. presso questo Ente, non ci hanno consentito di procedere all' apertura delle casse prima d' ora.

A parte uniamo, per eventuale controllo, una breve nota dei pochi rilievi emersi durante la verifica del loro contenuto.

Qui vogliamo esprimere ancora il nostro vivo compiacimento e la nostra sentita riconoscenza per averci reso possibile la presentazione ai visitatori del Museo di un materiale scientifico di così elevato interesse documentario ed illustrativo.

Gli oggetti esposti sono stati accompagnati da cartelli e didascalie recanti la dicitura "Proveniente dalla Soc. It. Radiomarittima - Roma". Ma è nostro intendimento che l' illustrazione di tali apparecchi - fondamentali nella storia delle radiocomunicazioni - in attesa di comparire nel catalogo del Museo, in programmazione, sia subito affidata al commento parlato di personale esperto ed idoneo.

Codesta spett. Società ci ha consentito di realizzare efficacemente, per quanto riguarda la storia della radiocomunicazioni quei fini didattici ed educativi che sono tra gli scopi essenziali del Museo.

Per questo rinnoviamo l' espressione dei nostri più sentiti ringraziamenti, porgendo deferenti ossequi.

n. 1 allegato

Figure 3 Letter from Guido Ucelli to SIRM, 14/05/1955. ASMUST, Allestimento sezioni museali, Telecomunicazioni, 1324 Cimeli Marconiani e Sala Marconi

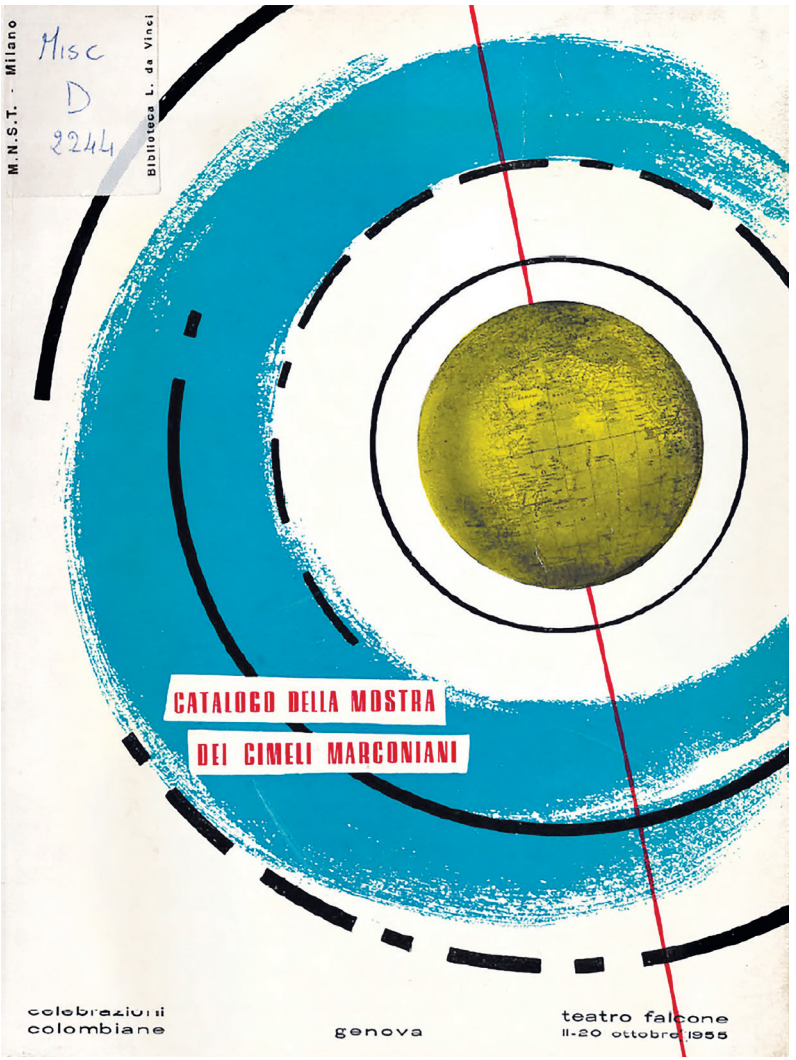


Figure 4 Cover of *Catalogo della mostra dei cimeli Marconiani* (11-20 ottobre 1955). Genova: Celebrazioni Colombiane. Biblioteca Museo Nazionale Scienza e Tecnologia Leonardo da Vinci

> technological progress of humanity made by academics and researchers from every country, so that visitors can learn about them and recall not only the names but also the patient endeavours, trials and technical efforts undertaken to effect these audacious and ingenious concepts.[20]

The ultimate goal is to gather together all of the Marconi relics (or at least the most important ones) in the future Marconi Exhibition Hall in a Historic Gallery of Physics:

> for the purpose not only of making Italians and foreigners alike aware of the prestigious work of the great Italian, but also of stimulating their *gratitude*, in a more effective and *evocative* way. (italics added)[21]

Rolla and Ucelli had a common goal: to ensure that the largest possible number of visitors fully engaged with the collected documentation. The educational aim had to coincide with the celebratory and spectacular objective, in accordance with the tone that defined Ucelli's vision for the museum (Canadelli 2016; Casonato, Canadelli 2019).

This public objective continued to overlap with the promotional interest of the Marconi companies, which worked together to allow the Marconi relics to encompass a dual function, both museological and commercial, as is confirmed in the terms of the collection storage. Although Ucelli, most likely adopting Soresini's vision, had made it clear that, when presenting the artefacts, the descriptive labelling provided by SIRM did not replace "the commentary of appropriate expert personnel", thereby indirectly asserting the epistemic authority of the Museum in interpreting the collection **[fig. 3]**.[22]

During the summer of 1955, tensions and fragilities emerged between the parties regarding the management of the artefacts. At that point different organisations were jointly taking care of them, in spite of their belonging to different worlds of research, culture and business, in which elements of state infrastructure were involved in various ways.[23] The artefacts were moved from Milan to Genoa in October at the request of SIRM, as per agreements, for a Marconian Artefact Exhibition organised for the Colombian Celebrations (Montefinale 1955). The sense of continuity between the objectives of the industrial

20 ASMUST, Corrispondenza II Serie, 909 Consiglio Nazionale delle Ricerche (2), b. Cimeli Marconiani, letter from G. Ucelli to G. Colonnetti, 09/05/1955.

21 ASMUST, Corrispondenza II Serie, 909 Consiglio Nazionale delle Ricerche (2), b. Cimeli Marconiani, letter from G. Ucelli to G. Colonnetti, 09/05/1955.

22 ASMUST, Allestimento Sezioni museali, Telecomunicazioni, 1324 Cimeli Marconiani e Sala Marconi, letter from G. Ucelli to SIRM, 14/05/1955.

23 The CNR was a public body, MUST semi-public, SIRM a sole provider of State services (Pietrangeli, *infra*). The company history of SIRM has still not been examined in depth. According to the current company bearing this name, resulting from the 2016 merger of "the branch of Leonardo Marine Electronics (formerly Finmeccanica) operating in the United Kingdom, already known as Marconi International Maritime Company" (MIMC), the origin of the Italian company can be traced to the 1927 transformation of the "Compagnia Internazionale Marconi per le comunicazioni marittime". This company was already an approved wireless services provider and was converted into SIRM following Law 1082 of 16/06/1927, which ratified the Royal Decree 1557/3/9/1926. This stipulated that companies receiving state concessions for merchant ships had to be "registered in the Kingdom with a majority of Italian capital and [...] have their headquarters in Italy" (Art. 1). SIRM was also financed by English capital, as we are reminded in the biography of Giovanni Treccani, who became a board member (`https://www.treccani.it/enciclopedia/treccani-degli-alfieri-giovanni_(Dizionario-Biografico)/`). From MIMC records of agreements, it appears that on 18/12/1928, SIRM issued bonds at 500 lire each totalling 9,256,000 lire, with a 5% interest rate redeemable over 20 years (OBL MS Marconi 1927, MIMC, Register of Agreements & C, 7,143). SIRM appeared to represent the full expression of the economic and organisational connection that linked Marconi and his companies to the Italian government. See Balbi, *infra*.

exhibitions and those of the Museum is evident.[24] Exhibiting the artefacts to the public meant not only celebrating Marconi and his technological innovations, but also certifying in some way the originality of those objects under Marconi Italiana's sponsorship **[fig. 4]**.

Nevertheless, not everyone in Rome agreed with the Milanese organisation envisioned by Ucelli, Rolla, and Chiodelli. Others claimed the right to Marconian Cultural heritage: in October 1955 Vittorio Gori, director of the Istituto Superiore di Poste e Telecomunicazioni (ISPT), and a member of the Ministry of the same name, wrote a letter to Chiodelli from the Centro Radioelettrico Sperimentale Marconi to say that he had asked the CNR to transfer the remaining artefacts to the ISPT, but that was not all:

> With the intention of establishing a permanent exhibition of these artefacts in a suitable space within this building, easily accessible to the numerous engineers and officials of the armed forces […]. For this purpose, it would be highly beneficial to be able to include in the proposed exhibition the artefacts of this Company which are currently located in Genoa, and in the long term others that could be obtained from Marconi London or other institutions. […] In this way enabling the creation of the most interesting and complete Marconian exhibition which experts in the field could widely experience and explore.[25]

Therefore, for Gori, the privileged target audience to enjoy the Marconi relics was not the general public but specialists. Nevertheless, Chiodelli continued to back Ucelli's 'cause'.[26] He then contacted his friends at the CNR. A personal memo recalls:

> [Rolla has disclosed that] the Ministry of Post and Telegraphs plans to build a dedicated Museum in Rome and would therefore be opposed to sending the artefacts in question to Milan. Dr. Rolla has however informed us that this plan depends on the fact that 6,000,000 lire was spent on the exhibition in Genoa and, due to the lack of funds, the Ministry believes it would be easier to obtain international financing for the new Museum, also covering expenses in Genoa, rather than finding a way to pay off the current debts. Regardless of the comments, Ingegner Ucelli pointed out that the Museum could take responsibility for materials that could be reused in the Milan exhibition.[27]

In a subsequent letter, Ucelli even offered to pay for the direct costs of the Genoa exhibition, counting on being able to use the installations again in the Museum. With the help of statistics he maintained that tens of thousands of visitors would then be able "to honour […] the work and the memory of Guglielmo Marconi in a concrete way".[28] Ucelli became a champion for the so-called 'science for all' movement, which

24 ASMUST, Allestimento Sezioni museali, Telecomunicazioni, 1324 Cimeli Marconiani e Sala Marconi, letter from R. Chiodelli to G. Ucelli, 21/10/1955.

25 ASMUST, Allestimento sezioni museali, Telecomunicazioni,1324 Cimeli Marconiani e Sala Marconi, letter from V. Gori to R. Chiodelli, 29/10/1955.

26 ASMUST, Allestimento sezioni museali, Telecomunicazioni 1324 Cimeli Marconiani e Sala Marconi, letter from R. Chiodelli to V. Gori, 03/11/1955; letter from Marconi Italiana to G. Ucelli, 17/11/1955.

27 ASMUST, Allestimento sezioni museali, Telecomunicazioni 1324 Cimeli Marconiani e Sala Marconi, internal memorandum, 08/11/1955. 'Ingegner' (Engineer) in Italian is a honorary title.

28 ASMUST, Allestimento sezioni museali, Telecomunicazioni, 1324 Cimeli Marconiani e Sala Marconi, draft letter from the MUST Presidency to the CNR Presidency, 08/11/1955.

Figure 5
W.G. Richards, ‘Publicity Manager’ for the Marconi companies from 1922, photographed in 1942. He was employed in 1920 as the deputy of Arthur Burrows, and subsequently replaced him when Burrows became the first Director of Programmes at the recently established British Broadcasting Corporation (BBC) (OBL MS Marconi d74)

had already been established in Italian museums since the liberal era. As it grew stronger during the second post-war period, the initiative spread to European and American museums (Govoni 2002; Canadelli 2016).

The CNR and Ucelli finally found a solution, allowing the Ministry to make copies for the ISPT, before returning the objects to Milan.[29] SIRM’s Marconi relics were moved from Genoa to Rome and then returned to Milan in April 1956, but it was in fact the copies that were sent. Soresini, who undertook to compile a list of the material received free of charge, immediately reported the error.[30] The originals returned on 23 April and in June 1956 the artefacts from the *Elettra* finally arrived as well. The Marconi exhibition hall at MUST could at last be

29 ASMUST, Corrispondenza II Serie, 909 Consiglio Nazionale della Ricerca (2), letter from F. Rolla to G. Ucelli, 17/11/1955.

30 Soresini did not hesitate to highlight the problem. He wrote that an “inferior copy” of a final version of the magnetic detector, a “quite well executed false copy” of the 7777 circuit and a “fraudulent replica” of the CNR 4-sphere spark gap. Allestimento sezioni museali, Telecomunicazioni, 1324 Cimeli Marconiani e Sala Marconi, F. Soresini, list, 07/04/1956.

set up and it was officially opened on 10 October 1956.[31] But the saga of the artefacts had not yet ended. In 1956 they were again requested by Rai (Italy's National Broadcasting Company) for a Radio Exhibition, while in 1957 they were again asked for by Rai for the Levante Trade Fair in Bari.[32] The clashes between the institutions over the Marconian legacy also continued: as early as 1958, the ministry sought the return of the *Elettra* artefacts for exhibition at the future Museo delle Poste e Telecomunicazioni (now the Museo Storico della Comunicazione, at the MISE – Ministry of Enterprises and Made in Italy).[33] Ucelli again managed to extend the stay of the artefacts at the Museum with the help of the CNR, but in 1978, with the presidency of Francesco Ogliari (Ucelli died in 1964), the *Elettra* artefacts were returned permanently to the Ministry where they are now housed.[34]

4 Origins and Meanings

The reconstruction of the museum 'biography' of the Marconi relics allows us to understand which parties cooperated in the creation of the core collection of objects and with what expectations. The mystery of the imprecise labelling procedure has become clearer. In the SIRM documents, the object now referred to as D-30 is a 'spark gap': a generic name for any device with that type of function. It is a matter of a technical and operational perspective. After all, SIRM's attitude is business oriented. On the other hand, in the habits of CNR, a body representing scientific research, the identical IGB-9718 assumes the lofty name of 'Righi oscillator', an explicit reference not only to the Bologna physicist but also to the theoretical concept of the oscillator, fundamental to physics.[35] As Marc Raboy observes, the young Marconi rhetorically emphasized his entry into the historic flow of predecessors by recognizing with this designation his debt to Augusto Righi, a physicist much more famous than he was at the time (Raboy 2016, 63). The origin and the dating of these objects remained a mystery, due to the significance given to the copies at the time. Who had really produced them? Where and when?

The examination of documents from the English parent company which are kept in the Marconi Archives in the Bodleian Libraries at Oxford University, places the Italian situation within a broader dynamic, in line with the international aspirations of the Marconi business. Documentation reveals that Radio Intelligence Ltd., a subsidiary company founded as a communication service in 1924, became the communication agency serving all the Marconi Company divisions from 1932 onwards. In this capacity, it was responsible for organizing all

31 ASMUST, Allestimento sezioni museali, Telecomunicazioni, 1324 Cimeli Marconiani e Sala Marconi, letter from MUST to Istituto Superiore Poste e Telegrafi, 23/04/1956. Letter from CNR to MUST, 07/06/1956. ASMUST, 908 Consiglio Nazionale delle Ricerche (1), letter from G. Ucelli a F. Rolla, 4/10/1956.

32 ASMUST, Telecomunicazioni, 1324 Cimeli Marconiani e Sala Marconi. Letter from Rai to MUST, 12/07/1957.

33 ASMUST, Corrispondenza II serie, 909 Consiglio Nazionale delle Ricerche (2), letter from F. Rolla to G. Ucelli, 14/02/1958.

34 Ogliari tried to defend the position of MUST in relation to the aims of the CNR, but on 9 April 1979 the *Elettra artefacts* were returned to Rome. ASMUST, Telecomunicazioni 1325 Sala Marconi, minutes of the board of auditors no. 43/87, 30/09/1987.

35 In physics, a device which, once appropriately energised, generates oscillating electrical currents (electrical oscillator) or alternatively mechanical oscillations (mechanical oscillator)

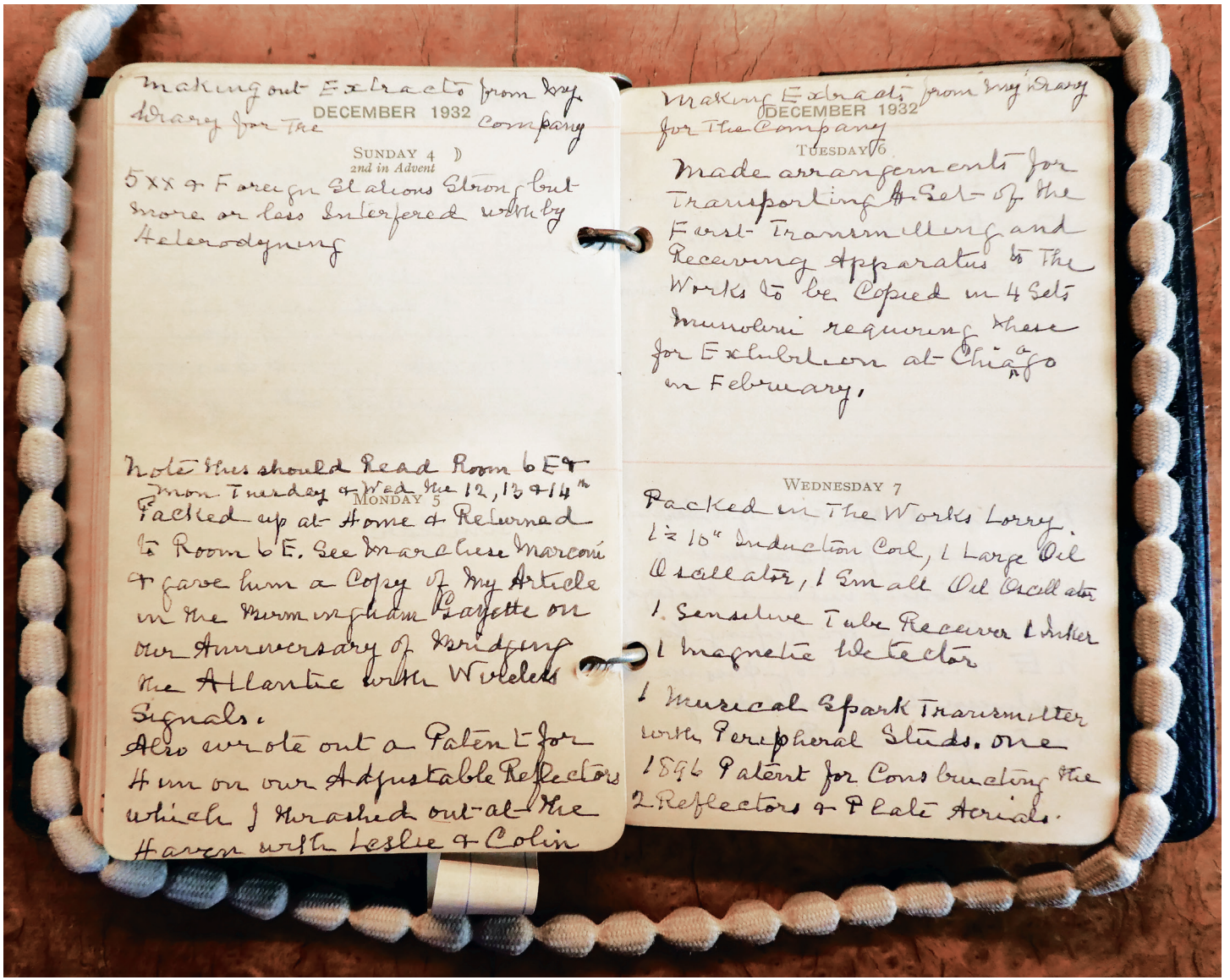


Figure 6 Extracts from the pages of George Kemp's diary from December 1932, Oxford (OBL MS Marconi 88), with notes regarding the reconstruction of the Marconi relics at the request of Mussolini and Marconi for the Chicago World's Fair in 1933. A "small Righi Oil Oscillator" is mentioned on 16 December, which would suggest that this terminology regained popularity when referring to Marconi's legacy

Figure 7
Model preserved by the Oxford History of Science Museum. It has an identical disk bearing no. 14, which might identify it as one of the four copies produced by Kemp, or at any rate, as an MWTC ‘promotional’ replica.

exhibitions.[36] They were largely promotional events, but often also included historical sections, as mentioned in some press releases. Of particular interest are the exhibitions connected to the commemoration of other scientists. For the centenary of Alessandro Volta (1927), the apparatus used by Marconi at his family home near Bologna in 1895[37] was loaned to the exhibition celebrating Volta at Villa Olmo in Como. The press release for the exhibition dedicated to Michael Faraday (1931) demonstrates that the type of ‘co-curatorship’ between companies and museums that was adopted in Milan in the 1950s was already used in London during Marconi’s lifetime **[fig. 5]**:

> A number of items of Marconi apparatus have been withdrawn from the Science Museum for the purpose of this Exhibition. These include replicas of apparatus used by Marchese Marconi in his earliest experiments in Bologna, in Italy in 1895.[38]

In this light, Marconi’s words to Ucelli, the head of the CNR in 1931, take on a new undertone, revealing a familiarity

36 OBL MS Marconi 1707, *Radio Intelligence Ltd.* report, 31/12/1935.

37 OBL MS Marconi 1707, *Volta Centenary Exhibition. Historical ‘Beam’ Apparatus*, press release, 28/05/1927. Alessandro Volta (1745-1827) was an Italian scientist, renowned for his groundbreaking studies on electricity.

38 OBL MS Marconi 1707, *Faraday Exhibition. Historical Marconi Exhibits*. Michael Faraday (1791-1867) was an English scientist renowned for his studies on magnetism.

with organised and modern promotional methods, in which marketing had become of considerable importance and exhibitions events of great appeal (Elmer 2017, 1840). The constant systematic relationship with the science museums shows the importance of the symbolic and narrative aspects of the science and technology development of the era, an objective that businesses and cultural entities cooperated on together in the name of progress (Natale, Balbi 2014). Marconi put all the organisational and technical capacities of his company at the disposal of Italian propaganda. The diary of Marconi's assistant, George Kemp, records some fundamental information for understanding this intention. On 6 and 7 December 1932 **[fig. 6]** Kemp notes having transported Marconi's first original apparatus from the London Science Museum to the Marconi workshops in Chelmsford ("to the Works"), to be copied in four sets, as "Mussolini requests them for the Chicago World's Fair in February". The following day Kemp notes the list of apparatus that he had loaded onto the company lorry: "1½ 10'' Induction Coil, 1 Large Oil Oscillator, 1 Small Oil Oscillator, 1 Sensitive Tube Receiver, 1 Inker, 1 magnetic detector, 1 musical transmitter with pepripheral Studs, one 1896 Patent for Constructing 2 Reflectors & Plate Aerials".[39] Comparing this list with the SIRM shipping document of 25 March 1955, there are the same types of objects, albeit with varying labels **[fig. 6]**.

If the Oxford archives and the literature of the period help to reveal semantic variations inherited from the past, meticulous observation methods, which are standard professional competencies in the art world and among cultural material experts, assist in identifying the common origin of objects and in dating them (Alberti 2022, 31). As well as the trademark of the English parent company, artefacts of different origins, from SIRM and CNR, also carry small circular disks engraved with sequential numbering. The Marconi Company document archives were transferred to the Bodleian Libraries in the 1990s, while the company collections of historic objects went to the Oxford History of Science Museum. A comparison with the photographic documentation relative to these objects, both contemporary and historical, reveals the presence of the same numbered disks, which seem to indicate that objects recovered from different places and donated to museums by different parties, share an identical point of origin and are part of a serial production of replicas. In each of the three copies taken into account the oscillator/spark gap bears the number 14 **[fig. 7]**.

Images from English trade fairs in the immediate post-war period show that the 'Marconi relics' circulated in the United Kingdom in the same manner as they would be in Italy shortly afterwards **[figs 8-10]**.

39 OBL MS Marconi 88. G. Kemp's Diary, 1932.

Figure 8
Photo of a display case in Marconi's 1947 Jubilee Exhibition in London, on the occasion of the 50th anniversary of the MWTC, from the Celebratory Dinner album (OBL MS Marconi 73). On the bottom left, one of the replicas of the Righi oscillator, also bearing a disk with the no. 14. Next to it two other typical Marconi relics: a wireless telegraphy printer and the first coherer receiver, of which MUST preserves a copy

Figure 9
Entrance hall of Marconi's 1947 Jubilee Exhibition, from the Celebratory Dinner album (OBL MS Marconi 73)

Figure 10
A trade-fair stand of the Marconi maritime division, the Marconi International Marine Communication Company, at the end of the 1950s. The exhibition showcased the latest wireless technologies for navigation alongside historical artefacts. There are some classic 'Marconi relics' at the centre of the photo: a coherer, a Ruhmkorff coil, a magnetic detector, and a crystal receiver (OBL MS Marconi c354)

5 Conclusions

Nicholas Thomas, the director of the Cambridge Museum of Archaeology and Anthropology, observed that museum procedures such as cataloguing, which seem trivial and routine, are in fact quite the opposite. They embody the essence of the museum, conceived as an authentic 'method' of knowledge production, which takes the form of some specific practices: physical contact with the artefacts, (re) discovery, description and comparison (Thomas 2010).

Research begins and takes shape because of the need to know precise information, such as the name of an object, its origin and its material characteristics. In this way so-called musealisation takes on a special role in the production of knowledge. It is the intentional extraction of special material 'specimens' from the fabric of contemporary reality, which are destined to become museum exhibits and to be preserved in order to stimulate new viewpoints on the world (Cirese 1977; Pearce 2012). In *Sorting Things Out*, Geoffrey Bowker and Susan Leigh Star claim that the ways in which we classify and standardise knowledge, even if at first glance they appear to be mere administrative procedures, incorporate world views and define customs and communities (Bowker, Star 2000). The museum catalogue is an important example of this. The historical configuration of how science museum catalogues have been compiled up to the present day, says a great deal about our historiographical conceptions of these objects.

This type of research in our digital era has taken on its own unique characteristics. Documentation is no longer limited to static paper files, from which the sequence of choices adopted by precursors emerges as a succession of well-defined layers. It is today rather a dynamic instrument, equipped with its own algorithmic logic that automates research and data correlation. It is a fundamental tool, which speeds up and broadens opportunities for knowledge, but which elevates the 'museum as method' and the phase of curatorial 'discovery' to a level of greater complexity. The tasks of labelling, description and comparison thereby become engaged in the fine-tuning of a complex "congruence engine" (Boon 2023).

The production and the distribution of the 'Marconi relics' tell us about the process of constructing symbolic aspects of science and technology, which relate to the social memory of their origins, and about which we are yet to fully understand the value. This process takes place by means of the exhibition and circulation in various contexts of cultural heritage, which is both material and intangible. It is carried out by a variety of agents who carry forward this legacy: the Museum, the CNR and the Italian Marconi companies. In doing so they convey differing aspirations, forming a community gathering around Marconi's cultural heritage, against the flourishing backdrop of the 'media century' (Tauschek 2015; Ortoleva 2009). Seemingly contradictory features coexist in this heritage, such as historical memory, national identity, educational needs and transnational dimensions. It is interesting to note that this dynamic also repeats itself in other themes and in other science and technology 'heritage communities', such as in the case of information technology (Casonato 2025).

The Marconi relics are scientific objects that skilled experts can use effectively in explaining the scientific principles of wireless communication. However, this quality cannot be separated from their identity as cultural objects, produced in the name of (motivated) patronage of scientific culture for the people, which lends itself well to the notion of Marconi as "the merchant prince of contemporary technology" (Monteleone 1995, 9).

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Numbered Marconi Relics: Official Replicas

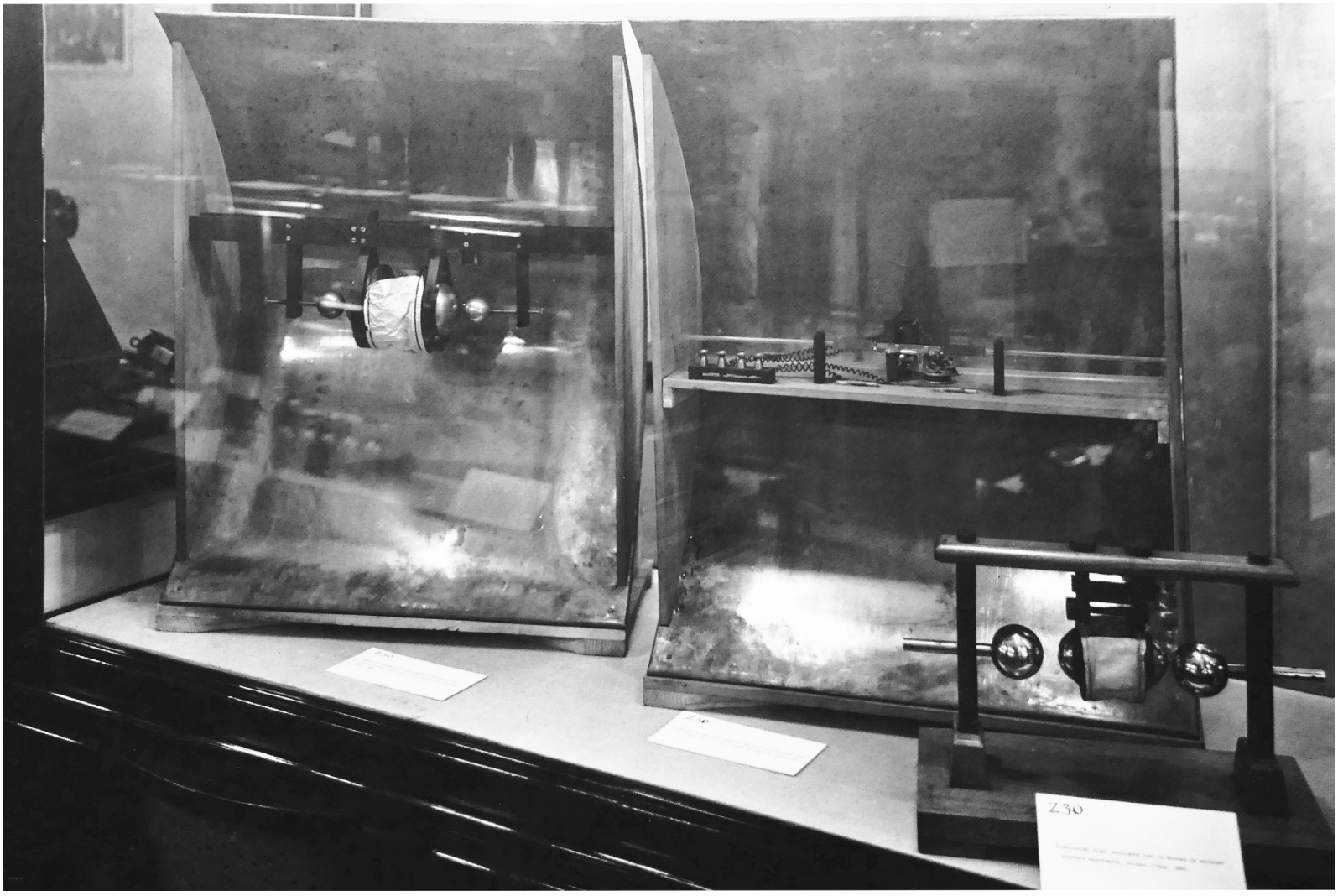
The following pages present a selection of objects which arrived in Milan between 1955 and 1956, and which were referred to at the time as 'Marconi relics' (Casonato, Spada, *infra*). Many of them feature numbered white celluloid labels that certify their belonging to a specific series of objects selected to tell the public about the origins of wireless communication 'according to Marconi'. It is not known when the labels were applied, but some of these artefacts are recorded in the list of replicas created for the 1933 Chicago World's Fair as reported in the 1932 diary of George Kemp, Marconi's assistant. Furthermore, identical labels are found on very similar objects, stored at the History of Science Museum in Oxford (where many artefacts were transferred from displays at the original Marconi Company headquarters in Chelmsford, Essex), and by the Griffin Museum of Science and Industry in Chicago, where they arrived at the same time as the World's Fair in 1933. It is interesting to note that numbers are found on artefacts given to MUST by diverse providers.[1] The following pages reconstruct the ideal sequence of the artefacts according to their numbers. The list is to be integrated by the readers with objects 'no. 14' and 'no. 4',[2] visible respectively at the beginning of chapters 1 and 3.

1 The information is obtained though comparison of correspondence in ASMUST, Allestimento sezioni museali, Telecomunicazioni, 1324 Cimeli Marconiani e Sala Marconi. See the lists written by F. Soresini on 3 and 7 April 1956.

2 At the Oxford Museum a 'no. 3' is affixed to the reproduction of the tuned circuit that MUST labels 'no. 4', while here a 'no. 3' is absent. It is not unlikely that an inversion occurred during one of the objects' numerous journeys. It is today unknown to which object the 'no. 8' was assigned, as it has not been found in any series.

Reproduction of experimental parabolic transmitter (no. 1) and receiver (no. 2)
inv. D-000032 and D-000031
Era of technology: 1896
Manufacturer: MWTC (Chelmsford), 1932-33
Provenance: SIRM, 1955

Reproductions of a pair of transmitter and receiver with directional parabolic reflectors, for wireless telegraphy experiments. These devices bear the labels ‘no. 1’ and ‘no. 2’. The originals were used by Marconi in 1897, under the auspices of the English General Post Office, to conduct demonstrations in the presence of the British Royal Navy at Salisbury Plain, south of London (Aitken 1976, 216). Identical artefacts with the same labels are housed at the HSM in Oxford (inv. 40344 and 59934). On the right, a display case of the Exhibition at the Albert Hall in London (22 September-2 October 1931) (OBL MS photograph d74).


230

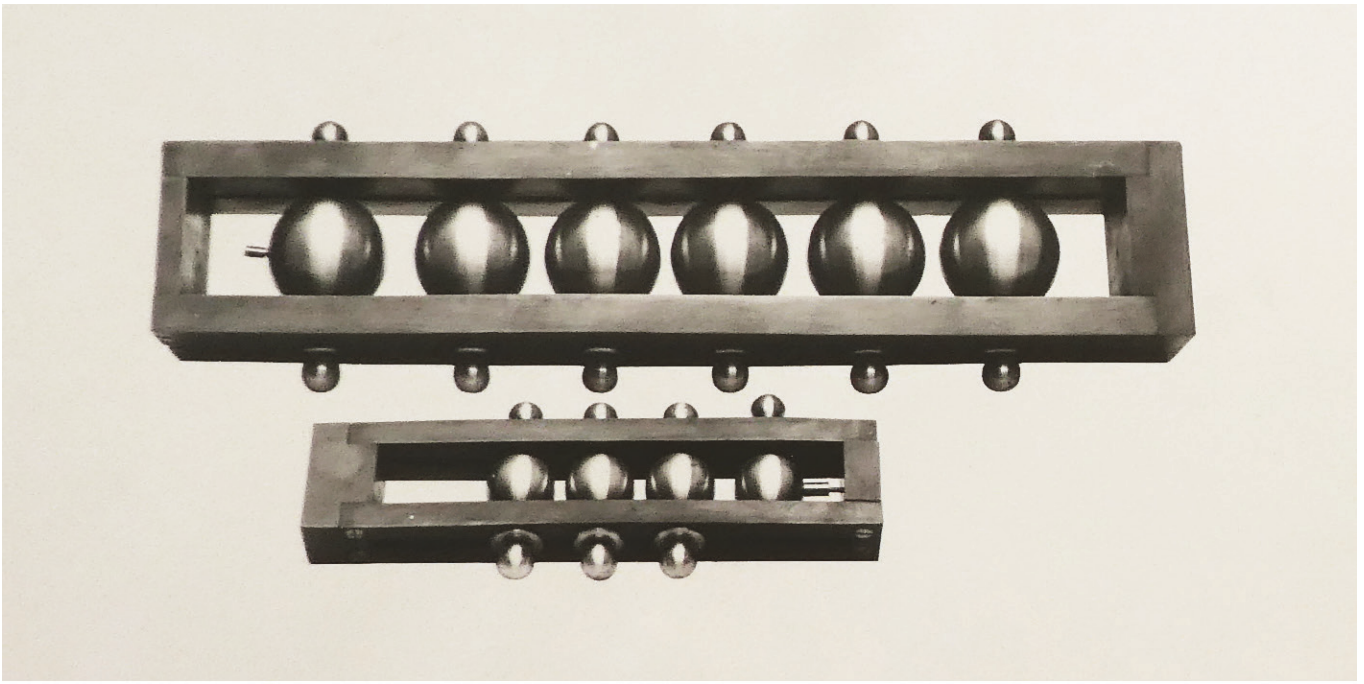
Rotary Spark Discharger for wireless telegraphy station (no. 4), with brass toothed disc (no. 5)
inv. IGB-012569 and inv. D-000034
Era of technology: 1907
Manufacturer: MWTC (Chelmsford), post 1907
Provenance: CNR and SIRM, 1955 and 1956

This type of radio waves generator was created by Marconi in 1906 and patented in 1907 (Baker 1970, 117). Also referred to as a 'musical spark', due to the frequency and the regularity of the spark discharges producing clear notes (Fleming 1916, 246). It was installed in the first large transmitting stations on the Atlantic coasts and later also on ships (Simion 1927, 88). MUST preserves two samples, coming respectively from SIRM and CNR (with label 'no. 4'). A toothed disc with finer teeth was provided with the machine. Two disc samples arrived at MUST, accompanied by a wooden support for display purposes, both with label 'no. 5'. In the archival photo on the right, similar artefacts are portrayed together on a white background, positioned for documentation or perhaps promotional purposes (OBL MS photograph b61).


1
2
SCALE OF INCHES
5
6

Reproduction of a multiple spark gap (ex no. 6?)
inv. IGB-002138
Era of technology: circa 1897
Manufacturer: Carlo Savio, Milano, 1956
Provenance: MUST, 1956

This artefact was produced in Milan in 1956 based on a replica which arrived from SIRM in 1955. This one, in fact, was stripped of its metallic spheres during the transfer of Marconi relics from Milan to Genoa for an exhibition and today only the wooden frame remains. This original frame still bears the visible circular mark of a label. Kemp listed this object among those to be replicated, and that there is an identical artefact at the HSM bearing a label 'no. 6' (inv. 59526; see also Casonato, Spada, *infra*, fig. 6), we can suppose that the original object that arrived at MUST bore the same label. The Oxford Marconi Archives preserves a photograph of the original artefact with its caption (adjacent, OBL MS photograph d74).



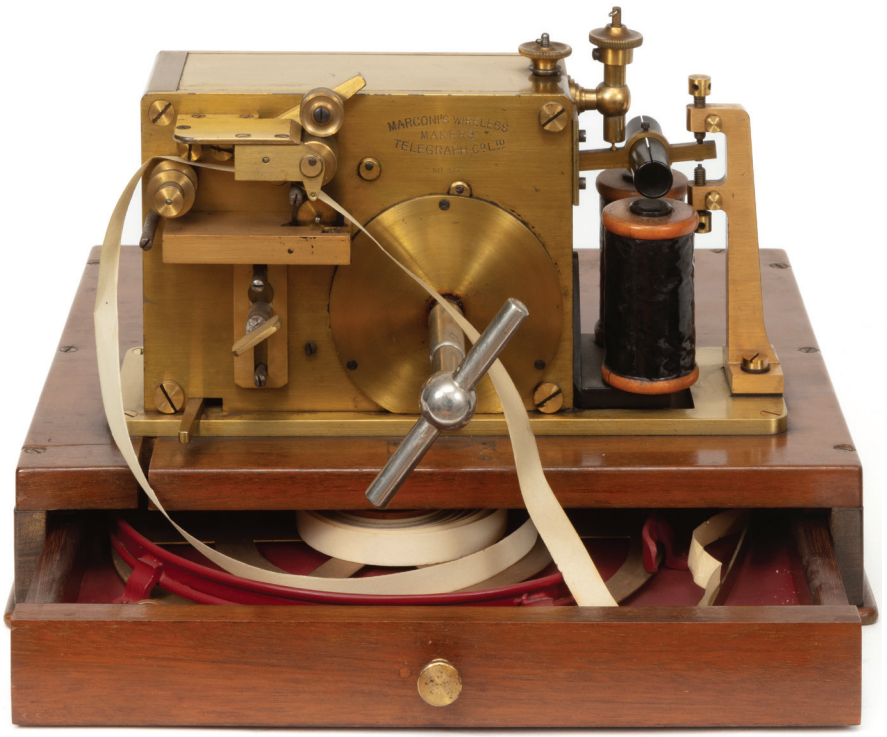
4036. TWO EXAMPLES OF THE MULTIPLE SPARK GAP WHICH WERE USED IN MR. MARCONI'S EARLY EXPERIMENTS IN 1897. THIS FORM OF SPARK DISCHARGER WAS EVENTUALLY MODIFIED AND TOOM THE FORM OF TWO SPHERES OF STEEL.

Reproduction of a coherer receiver for wireless telegraphy (no. 7)
inv. IGB-009862
Era of technology: 1896
Manufacturer: MWTC (Chelmsford), 1933?
Provenance: CNR, 1956

Reproduction of one of the first MWTC wireless receivers. Here we find, mounted on a wooden base the components from left to right are, a coherer (see adjacent); a small wooden box (the jigger which should be housed inside is not in place, see Guagnini and Chard-Cooper, *infra*) with clamps for the jigger of the tuned circuit; a larger container for the batteries (in the centre); and a relay. Identical artefacts also bearing the label 'no. 7', are housed at the HSM (inv. 67916) and GMSI (inv. 33.432). The object looks like the receiver pictured in the background in a well-known photograph of Marconi (OBL MS photograph c332), taken when the first transatlantic signal was transmitted from Poldhu (UK) to St. John's, Terranova (CA) in 1901.

Coherer (no. 11)
inv. D-000027
Era of technology: 1895
Manufacturer: MWTC (Chelmsford), 1933?
Provenance: CNR, 1956

The coherer, a small tube containing metallic filings and fitted with electrical contacts, was developed and used as electromagnetic wave detector by a number of inventors and scientists all over Europe in the nineteenth century. It was the first device used by Marconi in his experiments of transmission and detection of wireless signals. This exhibit features the first version used by Marconi. It has been isolated from the receiver and mounted on a wooden panel bearing a metal plate marked 'no. 11'. The object is very fragile and is damaged but still recognisable in form.



Morse inker for wireless telegraphic receiver (no. 9)
inv. D-000028
Era of technology: post 1897
Manufacturer: MWTC (Chelmsford), 1933?
Provenance: CNR, 1956

When connected to a wireless receiver, this device automatically wrote an ink trace on the paper tape imprinting the dots and dashes of the received Morse code signals. The tape was extracted from the drawer below. The apparatus is marked with the MTWC logo and the serial number 318. Morse inkers were already being used via cable in traditional telegraphy, but the company produced their own. They became obsolete with the introduction of the magnetic detector (Fleming 1916, 253-5).

Ruhmkorff induction coil (no. 10)
inv. D-000029
Era of technology: post 1897
Manufacturer: MWTC (Chelmsford), 1933?
Provenance: SIRM, 1955

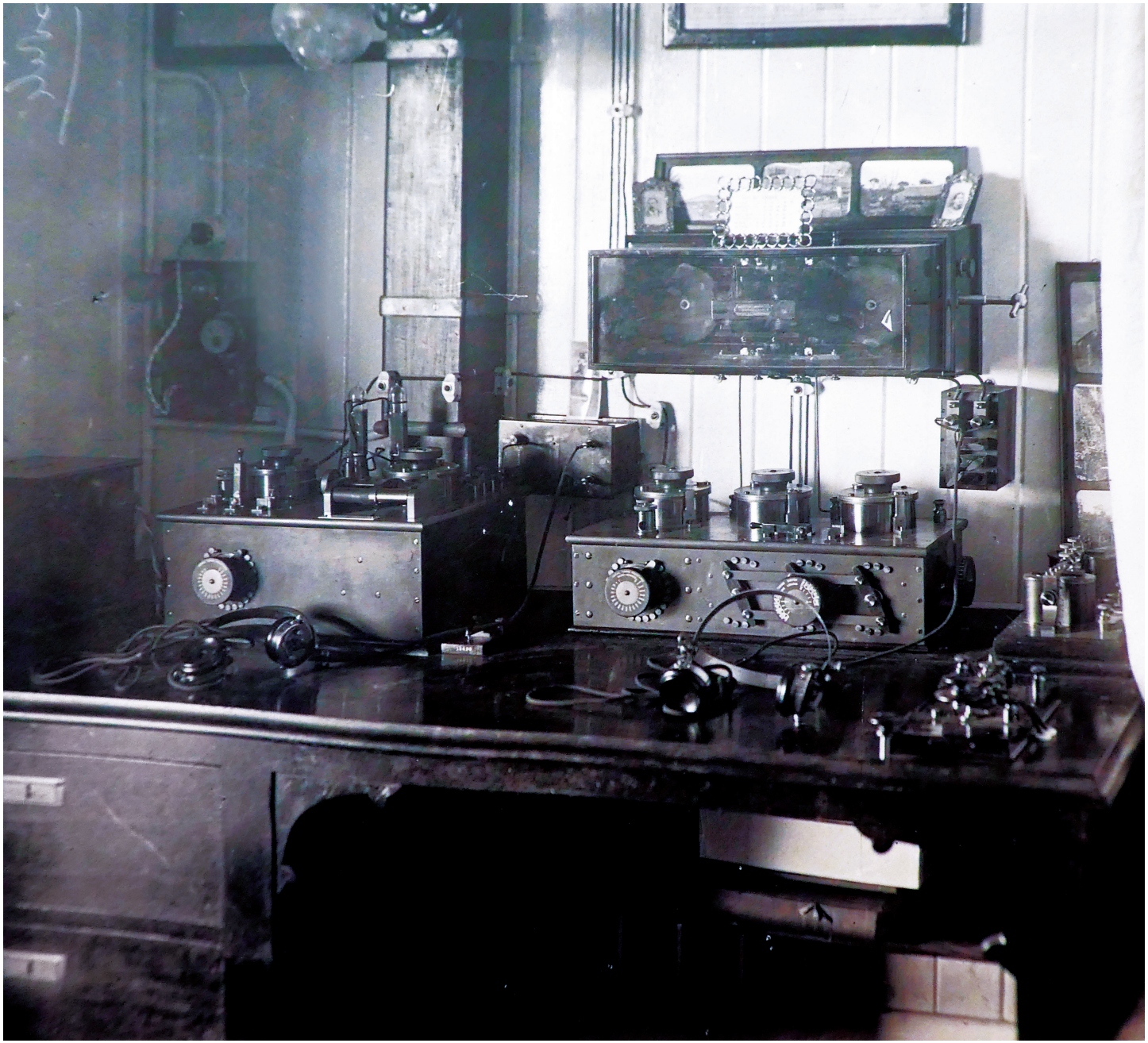
The induction coil was an electrical transformer developed by the scientific instrument maker Heinrich Ruhmkorff (1803-77) in the mid-nineteenth century and was commonly used in laboratories for research on electricity and its applications. It was a component of Marconi's first transmitting system. The MWTC produced its own induction coils, marking them with its logo. The artefact with label 'no. 10' is missing the two small insulating rods on which a spherical spark gap was mounted. These rods are instead still present on a very similar object produced at the Officine Radiotelegrafiche Marconi in Genoa (inv. CMND-002539).

Marconi Magnetic Detector, wireless receiver,
commercial model (no. 13)
inv. D-000036
Era of technology: 1902
Manufacturer: MWTC (Chelmsford), 1933?
Provenance: SIRM, 1955

The magnetic detector was patented in 1902 by the MWTC. It was a new receiving system for wireless telegraphy, based on an iron wire moving inside two coaxial copper windings. Morse code signals were made audible throughout a headset, instead of being printed. This artefact has the remains of a customs import docket for the New York World's Fair in 1939 sticked on it. It possibly indicates that it was used for demonstration purposes. The objects is also equipped with a wooden lid with a glass top (not photographed). This model was nicknamed 'Maggie' by its users.

Franklin Tuner
inv. D-000025
Era of technology: 1907
Manufacturer: attributed to the MWTC, post 1907
Provenance: unverified

Original device for the tuning of receiving apparatus. It allowed to operate on multiple frequencies by turning the knobs. It was designed by the MWTC engineer Charles Samuel Franklin (1879-1964) during the installation of a station in Russia and was patented in 1907. Together with magnetic detectors it was part of the standard equipment for large ocean liners (Baker 1970, 103). This sample has English labels but it was also marked by Officine Radiotelegrafiche Marconi in Genoa. It was possibly produced in the United Kingdom and was later serviced in Italy. Documentation of the period shows the tuner alongside the 'Maggie' in a wireless cabin setup on a ship OBL MS photograph d74.

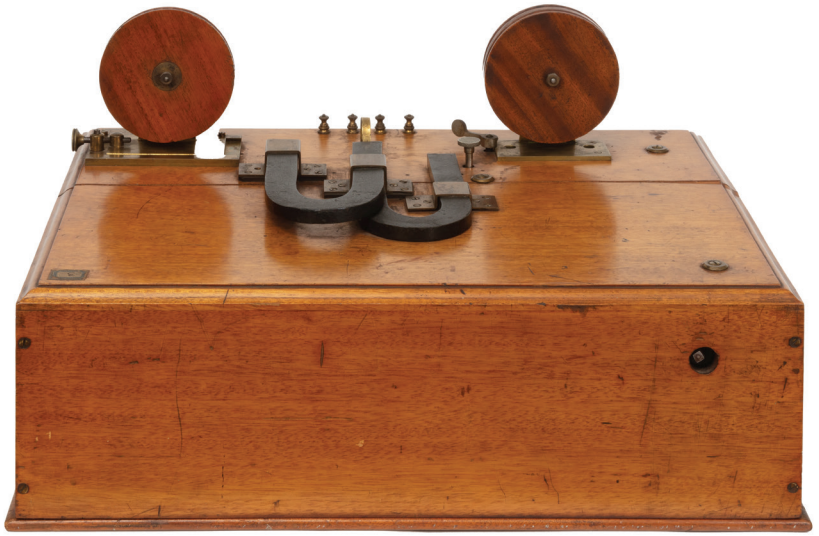


The detector is mounted on the wall; the tuner is sitting on the table underneath

Reproduction of a variable capacitor ‘Billi condenser’ (no. 15)
inv. D-000033
Era of technology: 1901
Manufacturer: MWTC (Chelmsford), 1933?
Provenance: SIRM, 1955

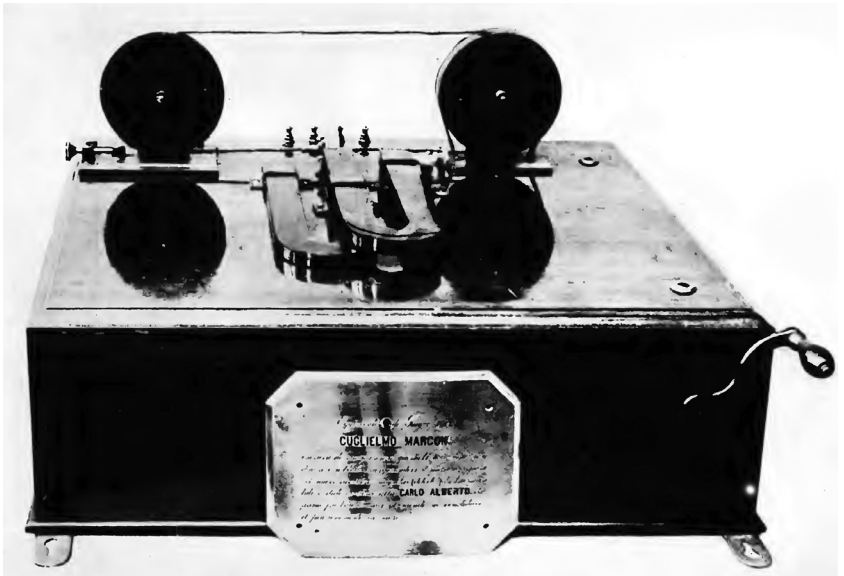
Reproduction of variable capacitor prototype known as a ‘Billi condenser’ used by Marconi in Terranova, probably to tune the kite antenna used for the first transatlantic transmission. The name may come from the word billifarad, that is a billionth of a farad, a unit of electrical measurement (Liffen 2013). The MUST specimen bears a circular disk featuring both the MWTC logo and ‘no. 15’. An identical replica is housed at the GMSI in Chicago (inv. 33.427).

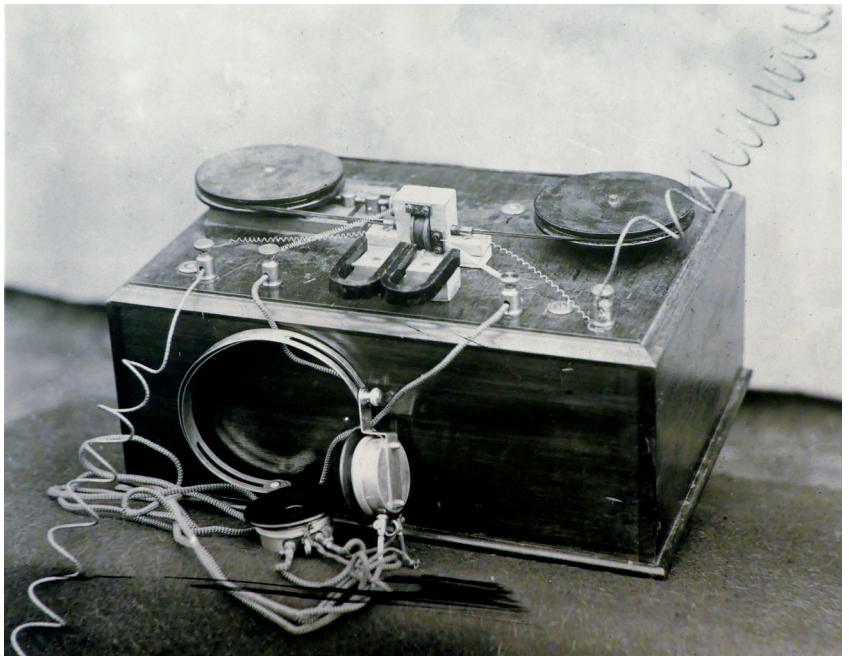
Students visiting the South Bank Exhibition during the Festival of Britain in 1951, in front of a display case entitled “The Birth of Radio” (OBL MS photograph b71). In the photo below we can see a Ruhmkorff coil and an industrial magnetic detector (mounted on the wall). Above: in the centre, a Morse printer and a jigger



Receiver ‘Prototype of magnetic detector’ inv. D-000035
Era of technology: 1902
Manufacturer: unknown post 1902-ante 1939
Provenance: SIRM, 1955

The origins of this object are unclear: it could be an original prototype constructed in 1902 by Marconi (or more likely by his assistants), or it could be a subsequent replica. It bears a customs import docket for the 1939 New York World’s Fair, indicating its connection to the other numbered artefacts used by the MWTC for fairs and exhibitions. An object designated as ‘first magnetic detector (definitive reproduction)’ arrived at MUST in 1955 along with the numbered ‘artefacts’, but it was not photographed. The curator F. Soresini maintained that it was the object mentioned in Admiral E. Simion’s report on the contribution of the Regia Marina Italiana (Royal Italian Navy) to the development of radiotelegraphy. Simion described this as “the first detector model” presented by Marconi to Admiral Mirabello on 26 June 1902, when the inventor boarded the ship Carlo Alberto to conduct his famous experimental campaign. Comparison with Simion’s photo, however, shows an inverted positioning of the horseshoe magnets (Simion 1927, 51 fig. 16; reproduced at the top of the next page).





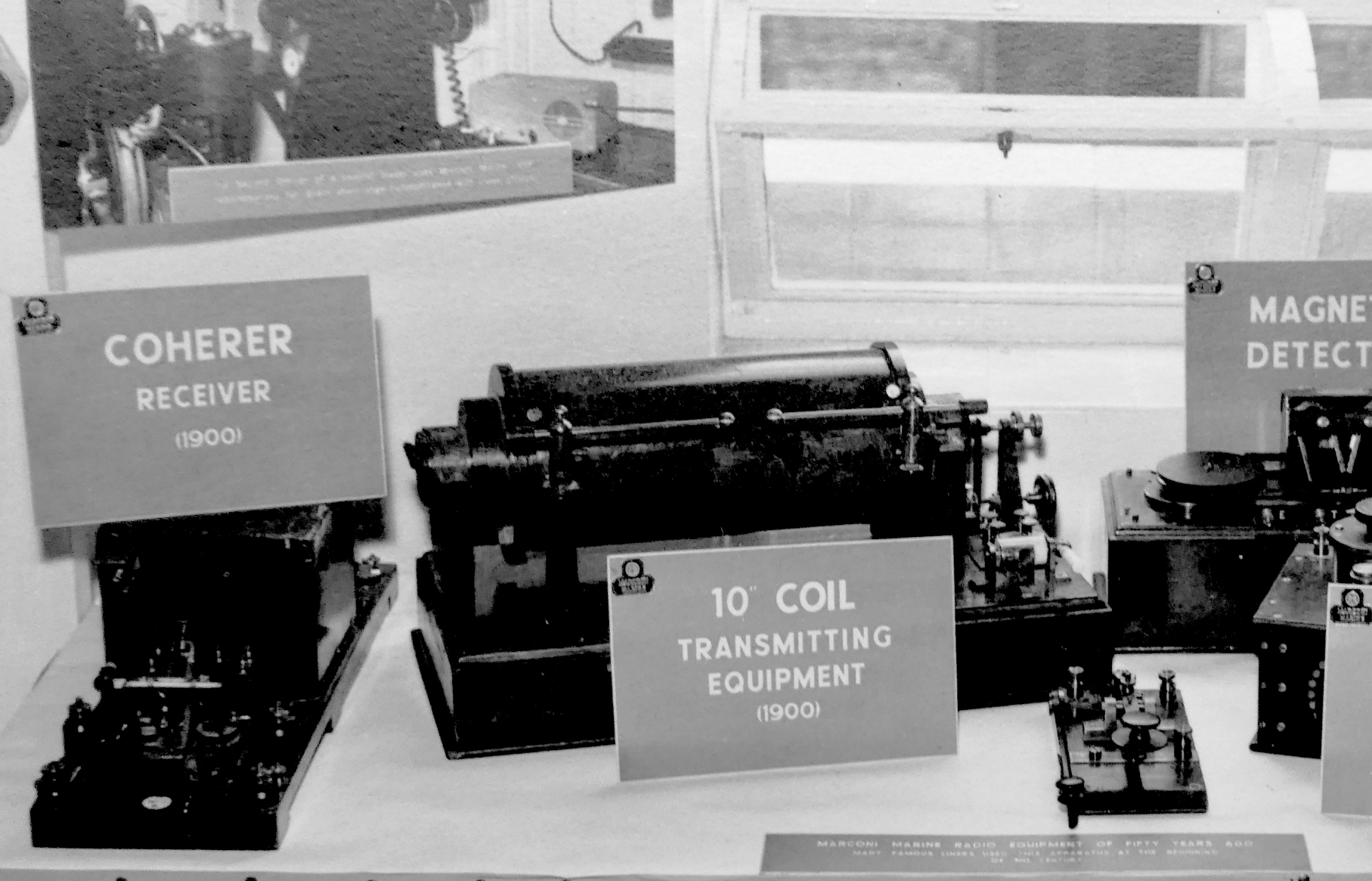
According to its original caption this image from the Marconi Archives in Oxford shows a 'second model' with a slightly different configuration (OBL MS photograph d74), which could confirm that the MUST object is in fact an older prototype (or its reproduction)

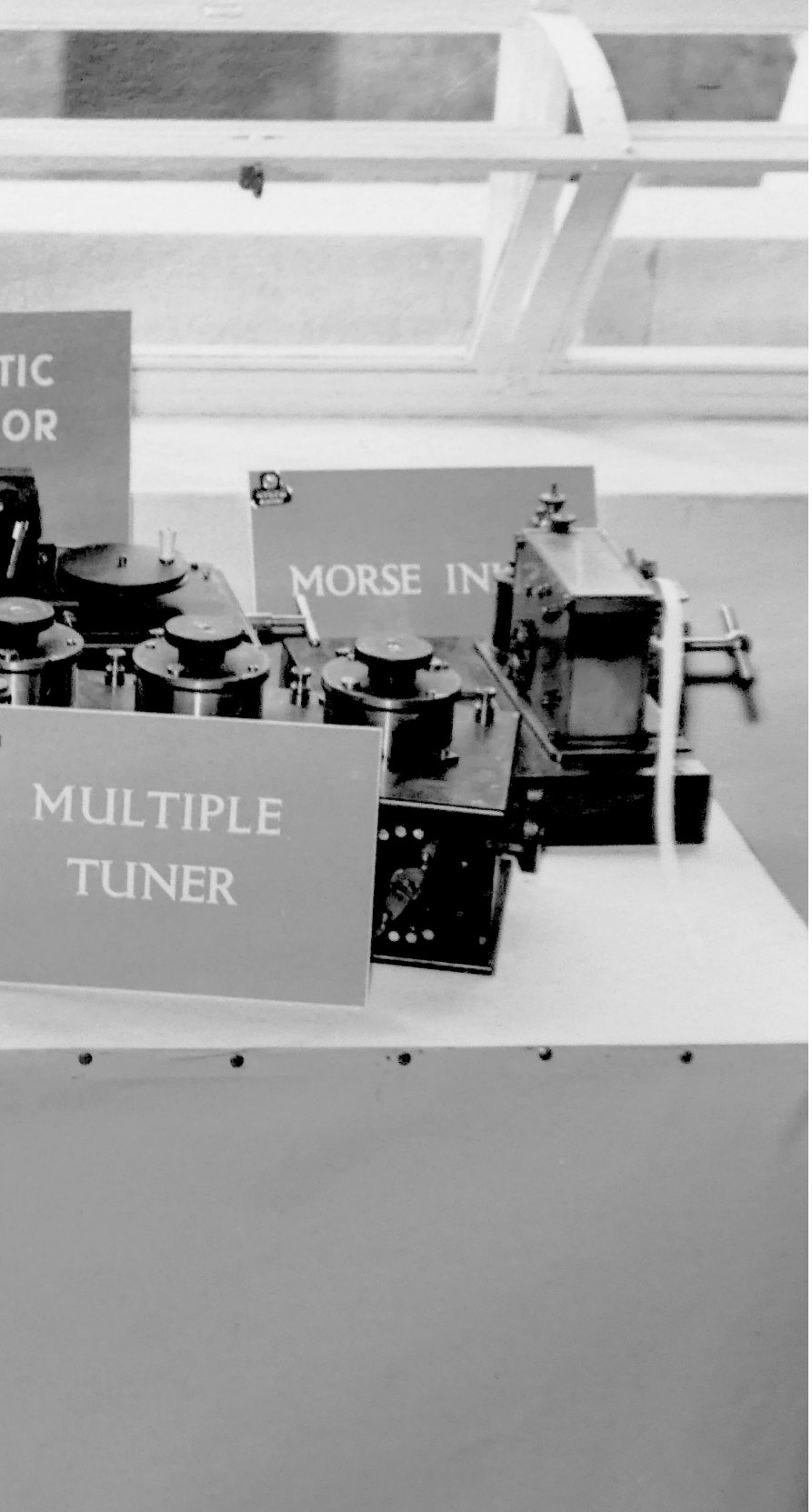
‘The Marconi Direct Reading Portable Decremeter’
inv. D-000020
Era of technology: 1909
Manufacturer: MWTC (Chelmsford), post 1909
Provenance: SIRM, 1955

Original portable instrument for the measurement of the frequency of electromagnetic waves, with calculation tables inside the lid. The instrument measured the wavelength in wireless transmitting stations. It converted them into sound signals through a telephone receiver (not present), allowing operators to test for correct operation. The detection of the waves was performed by a silicon carbide or carborundum crystal (not present). The device was equipped with an integrated sliding gauge, in the upper section, to facilitate wave measurement (*Description*, s.d., OBL MS Marconi 121). This article does not have a round celluloid label, but arrived at MUST in 1955 along with the numbered artefacts.

Double crystal receiver, with valve amplifier
inv. D-000022
Era of technology: post 1906
Manufacturer: MWTC (Chelmsford), post 1906
Provenance: SIRM, 1955

The receiving system used in this device followed the magnetic detector. The wireless signal was detected via silicon carbide (carborundum) crystals. The device used a 'Round triode' (see *infra*), as a signal amplifier. The crystals and the triode are missing from this artefact. The capacity of some crystals such as carborundum and galena (lead sulphide) to conduct current in only one direction was discovered in 1874 by Ferdinand Braun, winner of the Nobel prize alongside Marconi (Braun 1909). Crystal receivers were conceived by military engineers in the United States Army, such as General Henry H.C. Dunwoody, whose 1906 patent also prompted Marconi's engineers to develop receivers that "were to challenge the supremacy of the magnetic detector" (Baker 1970, 120). This relic does not have a round celluloid label, but arrived at MUST along with the numbered objects.


COHERER
RECEIVER
(1900)
10" COIL
TRANSMITTING
EQUIPMENT
(1900)
MAGNE
DETECT
MARCONI MARINE RADIO EQUIPMENT OF FIFTY YEARS AGO



Typical set of 'Marconi relics' on display at the Post Office Engineer's Exhibition in 1958, Hull College of Technology, Yorkshire (OBL MS photograph c354)

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https://doi.org/10.1179/1758120613Z.00000000026

Reproduction of the magnetic detector in a cigar box.1930s. Inv. IGB-2139

The magnetic detector is a device for receiving long-distance telegraph signal prior to the thermionic valve. It used the principle of magnetic hysteresis and the Faraday-Neumann Law to detect electromagnetic waves. It is made up of two coaxial copper coils, an iron wire running through them along their axis, and two horseshoe magnets positioned at the ends of the coils, their endpoints turning towards the wire. The magnets are positioned to magnetize the section of metallic wire near their poles in opposite directions. The inner spool is connected to the receiving antenna, while the outer one forms part of a circuit containing an amplifier, such as a headset or telephone receiver. When an electromagnetic signal reaches the antenna, activating the metallic wire to run through the system, a magnetic field is produced inside the inner coil. This causes a variation in the magnetic field through the outer coil, triggering a potential difference at its terminals, which can then be amplified by the circuit and transformed into sound. This mechanism was deemed much more reliable than the coherer, an earlier device that was considered unstable and vulnerable to atmospheric discharges, thus preventing a continuous signal reception. The fact that the magnetic detector is contained in a cigar box is a historical reference, disclosed by Luigi Solari in his 1940 biography on Marconi, about how the inventor created the magnetic detector in his room at the Haven Hotel in Poole, using makeshift objects such as magnets and a cigar box. This reproduction, dated back to the 1930s, was donated to the Museum by Guido Ucelli in 1956, who had received it as a personal gift from Marconi himself.

Guglielmo Marconi's Magnetic Detector in a Cigar Box. The 'Self-Made' Myth

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The artefact analysed in this text is a small, wooden cigar box of approximately 25 × 16 × 3 cm, with red and black coloured edges, and glued to a slightly larger wooden plank. We notice it is a cigar box because of the many inscriptions on the wood, and because of the remains of the revenue label near the box opening and the logo of the cigar brand Conte di Cavour. It also contains two horseshoe magnets, is attached to a wooden board replacing its bottom, and contains a coil of copper wires through which a braid of iron wire and silk passes.

This object is a reproduction of the prototype in a cigar box of Guglielmo Marconi's magnetic detector, a receiver of wireless signals (prior to the thermionic valve) which used the principle of magnetic hysteresis and the Faraday-Neumann Law to detect electromagnetic waves. Its functioning made it more reliable than the coherer, an earlier device which was deemed unstable and subject to atmospheric discharging, thus not allowing a continuous reception of the signal.

This 1930s reproduction was donated in 1956 by MUST founder Guido Ucelli, as it was originally a personal gift to him from Marconi.[1] From that moment on, it has always been on display in the three Telecommunication galleries.

This exemplar is not one of a kind: several exist in other Italian museums dedicated to telecommunications or to Marconi. Some are almost identical to this or datable around the 1930s

1 MUST catalogue entry IGB-2139. Some inventories indeed assert that it was built personally by Marconi. Inventario degli artefatti in Sala Marconi, ca. 1955, Scatola 17 "17 Materiali ex documentario CNR". ASMUST, Museo Industriale, Esposizioni. Pagina d'inventario del detector magnetico Marconi IGB-2139, ca. 1965, Scatola 6 "1365 Ottica – Marconi – Telecomunicazioni – Radiocomunicazioni". ASMUST, Allestimento sezioni museali, Inventari beni museali.

like this one; others are more recent. All have in common the myth they convey in material form: the story of how Marconi allegedly prototyped the magnetic detector in a cigar box, as told by Luigi Solari (1873-1957), Marconi's friend and manager of his Italian affairs.

What the unquestioned presence of this myth in museum narratives conceals is how Marconi himself used this kind of object to carry on the mythical narrative in the 1930s, when he was in the top positions of Italy's three main cultural and scientific institutions during Italian fascism. Following Carlo Ginzburg's (2004) approach to cultural history and reconstructing the biography of the object, we can use the cigar box as a source of 'clues' to observe the institutional relations between Marconi and MUST. Here, I will first present the 'material' myth conveyed by these cigar boxes, then its hidden history, which reveals Marconi's active role in promoting a heroic 'self-made' narrative through these objects and museums.

1 Marconi's 'Garage Moment'

If we open the box, we find a long inscription typed on a piece of paper glued to it, saying in Italian:

> REPRODUCTION OF THE MAGNETIC DETECTOR
>
> Devised and built by Guglielmo Marconi in 1901 and experimented in 1902 aboard the Italian R.S. [Royal Ship] "Carlo Alberto".
> Presented by H.M. the King of Italy to the Czar of Russia in Cronstadt [sic] (July 1902).
> The expedition on the Italian navy cruiser *Carlo Alberto* took place in the summer of 1902 and allowed Marconi to test the detector in order to make it marketable and avoid depending on other people's inventions and patents to receive wireless signals. (transl. by the author)

The myth of this crossing is told in a biography published by Luigi Solari, Marconi's friend and manager of his Italian affairs, including the Officine Marconi (Marconi Workshops), the Italian branch of the Marconi Company. Solari also managed Marconi's relations with the Regia Marina Italiana (Royal Italian Navy), as he was a Navy lieutenant, and with the Italian government, through the Ministry of the Navy.[2] He took part with Marconi in the 1902 radiotelegraphic campaign aboard the *Carlo Alberto*, as he had convinced the King of Italy Vittorio Emanuele III to host Marconi and his experiments on the warship, when the King sailed on it to join the coronation of King Edward VII of the United Kingdom and to meet the Russian Czar Nicholas II in Kronstadt (Raboy 2016, 208-9).

Solari published at least four biographical accounts of his friend. His full biography of Marconi is titled *Marconi: Nell'intimità e nel lavoro* (Marconi: In Intimacy and at Work) and was published in 1940, three years after Marconi's death.[3] It is indeed a vivid account, full of anecdotes and memories (many of which cannot be fully verified).

2 Regarding relations between Marconi, Solari and Italy, see Balbi and Pietrangeli, *infra*.

3 Marconi's full biography entitled *Marconi: Nell'intimità e nel lavoro* was published by Solari in 1940. It was later republished by Odoya in 2011 with a preface by Barbara Valotti. Other books by Solari are *Marconi: Dalla Borgata di Pontecchio a Sydney d'Australia* published in 1928 by A. Morano Editore, *Storia della Radio* published in 1939 by Mondadori and *Sui mari e sui continenti con le onde elettriche. Il trionfo di Marconi* published in 1942 by Fratelli Brocca Editori.

As Barbara Valotti states in her preface to the re-edition of Solari's book (2011), this first-person biography has hagiographic overtones and is greatly influenced by the historical context in which it was written. Solari wrote and published Marconi's biographies during the fascist Ventennio, and the Italian fascist regime was central in the creation of Marconi's myth in the biographies, as Solari's praise for the regime emerges from the text and it often mingles with his enthusiastic representation of Marconi (Raboy 2016, 672-30). At the same time, Valotti continues, it is undoubtedly an invaluable historical document, if we interpret it as an outline of the entrepreneurial and scientific contexts in which Marconi and Solari worked (Solari 2011, 7-10).

We can thus read this biography as the source of a discourse that has been very popular among Marconi's aficionados. Indeed, Solari offers a very detailed and colourful account of how the inventor gave his idea a material shape, starting from Ernest Rutherford's discovery, by fabricating the prototype in a cigar box:

> He left his workshop in Poole, got on his bicycle (as he did not have a car at the time), and rode to Bournemouth, a few miles from the Haven Hotel in Poole. He searched for some very fine iron wire and, after visiting several shops, found what he needed at *a beautiful florist* he knew, who used iron wire to support flower stems.
>
> Back in his workshop with what he needed, he asked one of his assistants to provide him with a small wooden box. *He was presented with an empty old cigar box, which he declared suitable for the purpose.*
>
> He then formed a thin braid with the wire purchased in Bournemouth and threaded a small cardboard tube onto it. On this cardboard tube, he wound a thin copper wire to form a coil.
>
> He then attached the two coil of wire described above to the inside of the cigar box, connected the ends of the first coil to two clamps fixed to the edge of the box, to which the antenna and the earth connection were also attached. He then connected the ends of the second coil to two other clamps also fixed to the edge of the cigar box. With these clamps were tightened the ends of the two cords of a telephone.
>
> Within the first spool, Marconi passed the braid of a wire through so that it could be easily moved. Close to the iron braid he placed two magnets. [An explanation of how the device works follows…]
>
> *In this way, the 'Marconi magnetic detector' was built*. (Solari 2011, 64-6, transl. and emphasis added by the author)

Marconi is portrayed in an agitated eureka moment: as soon as he realises the materials that he needs to materialise his invention, he gets on his bicycle to go find them. The cigar box, empty waste material, is portrayed as a serendipitous object that happened to be there and could find another, important use. The story is like a gospel parable, with a moment of realisation, followed by tense research for the solution, some tinkering described with thorough technical detail, and finally the declaration of success: "In this way, the 'Marconi magnetic detector' was built" **[fig. 1]**.

Solari spends time to explain the detector, using a popular science tone and representing himself trying out the device under the skilful guidance of the inventor, and when he assesses its functioning, he congratulates him:

> "Bravo Marconi!", I exclaimed, having ascertained the accuracy of what he had told me.
> But Marconi, who often switched to the subject of women when he was in a good mood, added: "Do you know who gave me this wire? *That pretty florist in Bournemouth, where I go sometimes to buy flowers*".
> And, because I smiled, he continued with a somewhat mischievous expression: "Think no harm. Besides,

there would be no harm in it. You know very well that *I, as a good Bolognese, am an admirer of beautiful women*". (transl. and emphasis added by the author)

The attention of the reader is quickly moved on to Marconi's attitude towards women and the florist, the only female character in this story and only connotated by the adjective 'beautiful' (*bella fioraia*), in an act of benevolent sexism (throughout the whole biography, Solari enjoys portraying Marconi as a lady-killer). The implicit assumption in the text is that Marconi only remembered where to find the fine iron wire because he remembered the beautiful florist and her trick for supporting the flower stems.[4]

The representation of Marconi we gather from the passage perfectly complies with the trope of the 'garage moment' that so often recurs in the media history and symbolically invests the foundational myths of the Silicon Valley and many technology companies, especially in the digital sector (Audia, Rider 2005; Godelier 2007). According to Peppino Ortoleva, whether it is the story of a tum-of-the-century inventor like Edison or Marconi, or a corporate narrative of a Big Tech company, the inventor-entrepreneur (typically, a man) is always portrayed as the lone genius shut away in his workshop or garage.

Ortoleva draws a common thread, between the nineteenth-century genre of the biographies of inventors and the contemporary trans-mediatic narratives of the Big Tech entrepreneurs and media moguls. Anecdotes about genius and serendipity, as well as difficulties in being acknowledged and in starting from poverty, are recurrent tropes that have allowed inventors to trace their mythology and build their own image as heroes of our time (Ortoleva 2019, 263-82).[5] These narratives shape our contemporary understanding of the relationship between innovation and society in at least two ways. They are often part of the Big Tech strategy of 'corporational determinism', i.e. the narrative attempt to present a Big Tech corporation and/or product as the only agents of sociotechnical innovation, thus as able to shape the past, present, and future of society (Natale, Bory, Balbi 2019).

In the story of the cigar box, the tropes of serendipity and genius mentioned by Ortoleva are widely represented. The cigar box is portrayed as the unexpected locus of innovation and evokes Marconi's ability and genius, reiterating the idea, typical of the engineering ethos, that an invention is only such when it is materialised in a prototype. The ability to craft a device with makeshift means denotes the relevance of materiality in the story and for the people remembering it, referring to it, and looking at it as inspirational.

The value of the cigar box is thus amplified by its legacy, made of all the cigar boxes in Italian museums related to Marconi and wireless history that are there to materially evoke Solari's story. Like any proper myth, this artefact tells and retells the same story, representing Marconi's creative flair and ingenious mind in making innovation.[6]

4 This story is found in other biographical accounts of Marconi: the 1922 *De Souza Manuscript* (MS Marconi 55, f. 177. OBL, Marconi Archives, Papers relating to Marconi and the development of wireless telegraphy, Personal papers of Guglielmo Marconi) written by Marconi's Chelmsford secretary Leon de Souza; and Solari's 1939 popular science book *The History of Radio*. While the former mentions a lingerie shop, the latter uses the same text as the 1940 edition but the part about Marconi the womanizer is left out.

5 Glen Fuller (2015) also analysed the 'tinkering in the garage' theme which led Steve Jobs and Steven Wozniak to create the Apple II and, as it is said, to set up Apple, defining the 'garage workshop' as a place for masculine action (practical, manual activities and fiddling), where the technology developed offers a world of opportunity, for example aiming for economic success and technological innovation.

6 Ortoleva (1996) stressed how many recurring themes linked to the biographies of the inventors were already circulating during Marconi's lifetime. They included his being a headstrong and precocious child, his constant attention for experiments considered crucial within a certain technological route, and the spasmodic attention for the difficulties encountered on his path to success.

Figure 1
The magnetic detector in the 1940 edition of the biography written by Solari.
Biblioteca Museo Nazionale Scienza e Tecnologia Leonardo da Vinci

In the Marconi Archives, George Kemp's (Marconi's Chief Assistant) 1902 diary, and the expanded extracts he wrote around 1930, contain a day-by-day summary of what they did. These documents show the efforts Kemp and Marconi made to find the best wires and coils to devise the prototype of the magnetic detector for approximately a month and a half, between the end of April and June 1902.[7]

At the Haven Hotel, where they were lodging, Kemp and Marconi (when present) started looking for the best conductor for the coils of the 'new magnetic detector in Mr. Marconi's room' through a trial-and-error process. On 27 April they started receiving signals on the magnetic detector. Marconi left again on 29 April and Kemp conducted the experiments on his own. The experiments carried on throughout May: Kemp continued making magnetic detectors for days.

On 7 June, we read for the first time about cigar boxes: "I made a set of magnetic detectors in cigar boxes"[8]

7 Expanded extracts from George Kemp's diaries, ca. 1930, MS Marconi 92. OBL, Marconi Archives, Papers relating to Marconi and the development of wireless telegraphy, Personal papers of George S. Kemp.

8 "Note on a Magnetic Detector of Electric Waves, which can be Employed as a Receiver for Space Telegraphy" by G. Marconi, M.I.E.E. Communicated by Dr. J.A. Fleming, F.R.S., 12 June 1902, MS Marconi 49. OBL, Marconi Archives, Papers relating to Marconi and the development of wireless telegraphy, Personal papers of Guglielmo Marconi.

Figure 2
Exterior of the cigar box lid.
On the left, the logo of the Conte di Cavour cigars, featuring the House of Savoy coat of arms and the red *fascio littorio*.
Museo Nazionale Scienza e Tecnologia Leonardo da Vinci, inv. IGB 2139

(Raboy 2016, 202; 208). He kept making them for the next two days. While, on 12 June, Marconi sent John Ambrose Fleming to deliver a lecture on the magnetic detector at the Royal Institution of Great Britain, the testing of detectors went on – and cigar boxes are explicitly mentioned – until 17 June (Kemp worked even while he was confined to bed with influenza).[9] In the meantime, the *Carlo Alberto* sailed from Naples with Luigi Solari and Admiral Carlo Mirabello on board (Raboy 2016, 209). On 10 June Solari writes they got to Poole (a town near Bournemouth) on 15 (2011, 67). Marconi went on board the warship on 26 June to leave Poole the following day. Between 15 and 26 June, Marconi and Solari met and, according to Kemp's diary and expanded extracts, they indeed played with the detector. When George Kemp wrote in his diary "Today Mr. Marconi tested the magnetic detectors for the benefit of Marquis Solari" (the only plausible moment on the diaries in which Solari might have witnessed a garage moment), it was 22 June, almost time to embark on the *Carlo Alberto*.[10]

By the time of Solari's visit, many cigar boxes had already been built.

9 "Note on a Magnetic Detector of Electric Waves, which can be Employed as a Receiver for Space Telegraphy" by G. Marconi, M.I.E.E. Communicated by Dr. J.A. Fleming, F.R.S., 12 June 1902, MS Marconi 49. OBL, Marconi Archives, Papers relating to Marconi and the development of wireless telegraphy, Personal papers of Guglielmo Marconi.

10 Kemp's diary recounts: "Marquis Solari + Mr. Marconi try the Magnetic Detector". Furthermore, Solari reports subsequent conversations with Admiral Mirabello in accordance with Kemp's Diary (Solari 2011, 68-9). Expanded extracts from George Kemp's diaries, ca. 1930, MS Marconi 92. George Kemp's 1902 diary, 1902. MS Marconi 58. OBL, Marconi Archives, Papers relating to Marconi and the development of wireless telegraphy, Personal papers of George S. Kemp.

2 The Cigar Box and the Founding of MUST: Consolidating the Garage Narrative

What role did MUST have in the diffusion of Solari's material myth? A clue that we gather from Guido Ucelli's cigar box helps us understand when the box was produced and how the myth was disseminated. It is in the logo of the Conte di Cavour cigars **[fig. 2]**. Next to the portrait of Camillo Benso, Count of Cavour, is the coat of arms of the house of Savoy (the Italian Royal Family) on the left and the *fascio littorio*, the symbol of Italian fascism, on the right. This means that the cigar box at MUST was assembled between the 1920s and the 1930s. A comparison with a box of Cavour cigars confirms that this box was serially produced in that period by SAFFA (Società Anonima Fabbriche Fiammiferi e Affini), a match company based in Piedmont and Lombardy.[11]

Ucelli and Marconi met at the end of the 1920s: Ucelli was called upon to report on the work of the municipal commission for an industrial museum in Milan at a meeting of the directorate of the CNR, of which Marconi was president and which Mussolini had commissioned to set up a national museum of science and technology (Redemagni 2011, 146). It is from this encounter that a valuable alliance for Ucelli's project will be established.

The incoming 1933 *A Century of Progress* World's Fair in Chicago reinforced this alliance. On this occasion Marconi had confirmed the CNR's production of reproductions of instruments, machines, and objects representing ltalian excellence in the technical and scientific fields; at the same time, he had called upon Ucelli – as president of the Riva, a leading company in the production of turbines and pumps – to present three objects exemplifying the technologies developed by the company, as well as material relating to the recovery of the Navi di Nemi that he had conducted (Giorgione 2018, 53-5).

One of the objects exhibited at Chicago World's Fair in 1933 was exactly a cigar box bearing the same iconography and made of the same materials as Ucelli's box **[fig. 3]**.

An article from the magazine *L'Illustrazione italiana* reporting on the second edition of the Chicago World's Fair says:

> Marconi *personally showed* to the authorities who visited the exhibition the devices he invented and built […]. Among other things, he showed with particular satisfaction a cigar box containing the magnetic detector built in 1901 [sic!] and tested on board the *Carlo Alberto* during the crossing from England to Russia. ("L'Italia scientifica all'Esposizione Internazionale di Chicago" 1933, transl. and emphasis added by the author)

Therefore, Marconi himself had embraced Solari's 'garage' story before it was published, and had the detector built in a cigar box to create and reinforce his portrayal as the ingenious national hero with the help of Solari's myth.

The Chicago World's Fair and the massive political influence Marconi had on the foundation of MUST as a national museum consolidated the relationship between Marconi and the Museum in two ways. In one respect, the future Museum secured the promise of one of the four CNR copies of collections for Chicago and for other important science and technology museums around the world, alongside the

11 "Counte di Cavour cigar box", inv. IGB-11554, Museo Nazionale Scienza e Tecnologia Leonardo da Vinci. Print of the MUST catalogue entry dated 2012.

Figure 3
The cigar box reproduction displayed at the 1933-34 Chicago World's Fair, as published in the article "L'Italia scientifica all'Esposizione Internazionale di Chicago" 1933. Courtesy of Biblioteca De Gemmis, Città Metropolitana di Bari

Documentario dei primati scientifici e tecnici degli Italiani,[12] which confirmed Marconi among such firsts.[13]

Second, Marconi could place his hopes in the national museum project to secure the narrative of technoscientific hero that he had built through his influence on the Chicago World's Fair. Marconi, who had always been interested in controlling his own image and narrative, could rely on a strong position of power in the Italian fascist hierarchy: he was President of the three major cultural institutions in the 1930s, namely CNR, Reale Accademia d'Italia, and Istituto dell'Enciclopedia Italiana Treccani. He could also trust on a cultural climate

12 On the complex issues relating to the collections and the *Documentario*, see Reali 2018; Giorgione 2018; Canadelli 2018.

13 List handwritten by Franco Soresini: "MATERIALE CONSIGLIO NAZIONALE DELLE RICERCHE passato al MUSEO DELLA TECNICA", 1 October 1952, Scatola 5 "1324 Cimeli Marconiani e Sala Marconi". ASMUST, Allestimento sezioni museali, Telecomunicazioni; Reali 2018.

made of institutions and personalities, including Mussolini himself, who were ready to glorify him as an Italian inventor and scientist.[14]

Part of Marconi's strategy to promote his 'self-made' myth could have been to gift important institutions and people with a cigar box, a symbol of the *Carlo Alberto* expedition which had been possible thanks to the Italian Royal Navy, therefore an all-Italian endeavour, compatible with nationalist fascist values exalting Italian ingenuity. These important people certainly included Ucelli, who was on track to establish a national museum dedicated to science and technology in Milan.

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14 On Marconi's cult of personality and his institutional roles in Italian fascism, see Raboy 2016, 552-60. The 1932 work of scientific disclosure by Francesco Savorgnan di Brazzà entitled *Da Leonardo a Marconi*, glorified Marconi and compared him to Leonardo da Vinci, another fascist icon.

A reproduction of an experimental tuned transmitter circuit as described in patent no. 7777, issued to Guglielmo Marconi and the Marconi's Wireless Telegraph Company Ltd., 1932, inv. IGB 002137

This reproduction of an experimental oscillation transformer for transmitting apparatus, the so-called 'jigger', is made up of a square wooden frame, into which are fixed a Leyden jar (an early type of electrical capacitor invented in the Netherlands in the mid-eighteenth century which was still in use at the end of the nineteenth century) and a spark gap or a brass sphere electrical oscillator. The jar, which was used to condense the energy supplied by a battery (not present), was connected to the spark gap and to the wire wound around the frame. The jigger served to connect inductively the circuit of the spark gap generating electromagnetic waves (the radio signal) to the earthed antenna circuit designed to transmit them (Fleming 1906, 44-5; Hong 2001, 62). The type of waves transmitted varied according to its characteristics (the length of the primary and secondary wires, the number of coils). A receiver equipped with an oscillation transformer tuned to the jigger of the transmitter had the capacity to selectively receive wireless signals. The artefact features a wall-mounted pedestal with a back panel at the top of which is attached a circular celluloid plate bearing the no. 4, similar to those found on other Marconi relics (Casonato, Spada, *infra*). It was given to MUST in 1955 by SIRM, one of the Marconi Company's Italian subsidiaries. MUST houses another identical object (IGB-009882), currently on display in the Marconi exhibition area, but it has no plate markings. In his 1932 diary George Kemp, one of Marconi's assistant, lists the objects which were reproduced in four copies for the 1933 Chicago World's Fair. The exhibition catalogue *A Century of Progress* mentions the copy of an "Experimental tuned transmitter" (OBL MS Marconi 88. G. Kemp's Diary, 16/12/1932). The 'Marconi's Wireless Telegraph Company' brass plate is also present on an identical replica kept in the Oxford HSM (inv. 64464). Four screw holes and the outline of a missing plate are visible at the bottom of the artefact in the photograph. These clues lead us to believe that it is one of the display models produced for the Chicago World's Fair, or at the very least, as MWTC display material.

The Jigger. Probing the Fieldwork of Marconi's Assistants (1897-1901)

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> At that time wireless was not recognized as a definite branch of electrical engineering, and engineering opinion was dubious as to its future, but in the Marconi Company, and amid the buoyant atmosphere which surrounded its chief, no one had time to worry about trifles such as the prospects; we went all out to master the problems of the moment, and the future had to take care of itself.
> Henry Dowsett, "How I Began". *Daily News*, 27 August 1927

In 1900 Marconi filed the application for the 7777 patent, which was of fundamental importance to the development of his system of wireless telegraphy, both from a commercial and a technological perspective. The innovations described in that patent constituted an important step forward in the attempt to achieve the crucial goal of tuned transmission, while at the same time enabling a considerable increase in communication distances. The device at the heart of this innovation was the jigger, a frequency transformer, which in both its prototype and commercial versions often features among the most iconic artefacts displayed in Marconian exhibitions.[1]

Jiggers have a long and complex history, which began as early as 1898, during the course of which their characteristics and operational usage were gradually modified and improved.

1 Jigger was one of the colloquial and generic terms used in the second half of the nineteenth century by English engineers and technicians to refer to both machines and machine components. In one of H.G. Wells' science-fiction short stories, "In the Abyss", which features Victorian engineers and technicians as protagonists, the inventor of a deep-sea submersible describes it as a jigger (Wells 1897, 73).

This step-by-step process, which emerges thanks to the detailed examination of the material characteristics of these artefacts and the related documentation, provides an opportunity to analyse the distinctive aspects of Marconi's experimental approach and the environments in which the research was carried out. In particular, the case of the jigger allows us to highlight and draw attention to the role of the group of technicians from Marconi Wireless Telegraph Company (MWTC), whom Marconi himself described as his assistants.

Some of Marconi's collaborators are well known and often referred to in the literature on the history of wireless telegraphy: his loyal attendant George Kemp, the experimental physicist and electrical technology expert John Ambrose Fleming, who was a long-time consultant for the MTWC, and the company employees who subsequently became renowned in the wireless sector, most notably Charles S. Franklin and Henry J. Round. Nevertheless, very little emerges from the Marconian narrative about the work of other young technicians who were part of that group of assistants. Even when some of the collaborators are mentioned, their contribution towards the development of this new form of communication technology is not examined in detail.[2] Yet the important role played by the assistants is abundantly documented in the company records of the Marconi Archives at the Oxford Bodleian Libraries, and it was repeatedly acknowledged by Marconi himself.

In this essay the artefacts act as an insight into the activity of Marconi's closest collaborators; the purpose is to offer an appreciation of the extent of their involvement in the experimental work of their leader and of their contribution to the success of his system.

1 A Promising But Imperfect System

Only four years after obtaining the first patent, Marconi's wireless telegraphy apparatus succeeded in transmitting over distances long enough to generate interest in potential customers. However, the negotiations for the commercialization of the MWTC equipment stalled as a result of unresolved drawbacks which caused the system to be insufficiently reliable.[3]

The disturbances caused by atmospherics, and above all the interference between stations operating simultaneously, were among the most serious handicaps. Due to these problems, the system was unable to ensure the privacy of communications. In cases where contact had to be established between ships at sea – and between ships and shore stations – for safety information relating to navigation, the reception of messages by whoever had access to wireless apparatus was obviously a positive feature. Nevertheless, when it was a matter of communications whose content was exclusively intended for specific recipients, the lack of selectivity was a serious deterrent. Not surprisingly, communication confidentiality was one of the requirements stipulated by the English army, both by the War Office and the Royal Navy, for the purchase of MTWC equipment.

Faced with negotiations that could not be finalized, Marconi and his company had to focus their efforts not only on extending the range of communications, but also on finding a solution to the selectivity problem. Those efforts were all the more crucial because syntony had

2 A partial exception is the overview on the community of Marconi's assistants emerging from chapter on "The Old Time Engineers" in Baker 1970.

3 Marconi himself described the long series of laborious passages leading up to the 7777 patent in Marconi 1901.

been one of the key features of Oliver Lodge's 1897 patent for a wireless telegraphy device.[4] In fact, not unlike other startup companies based on ground-breaking new technologies, the main activity of the MWTC in its first years of business consisted exclusively in an attempt to improve the system and make it commercially viable.

It was no coincidence that the Royal Navy only decided in July 1900 to order wireless equipment for 26 ships and six land stations when the company announced it had made advances in tuning. It was the first important contract obtained by the MWTC. In 1901 the company began to receive orders for both ship and land station installations; admittedly, sales remained well below the expectations of Marconi and the company shareholders, but those first contracts were the commercially tangible result of the strenuous effort to improve the quality of communication. It was a success that Marconi achieved also thanks to the effort put in by his assistants.

2 The First Assistants

Until the establishment of the company, Marconi had conducted his research with the assistance of staff put at his disposal by the British General Post Office, thanks to the patronage of its Engineer in Chief, William Preece, and the technical personnel of the Royal Engineers. Of particular note was Captain John N.C. Kennedy, appointed in 1897 by his superiors to oversee the Salisbury Plain experiments, who continued to lend his backing and enthusiastic support to Marconi until 1899. Captain Baden F.S. Baden-Powell (brother of Robert, founder of the Scout movement), a pioneer of aviation and an expert in the military use of kites and balloons, taught Marconi how to fly them as an alternative to poles and masts for raising the wires. The assistance provided by the Royal Navy technicians was also considerably valuable, and so was above all the generous support and encouragement offered by Henry Bradwardine Jackson, a Royal Navy captain and a wireless telegraphy pioneer himself.[5]

However, when the MWTC was incorporated in 1897, the General Post Office withdrew its support. At that point, if Marconi was to be able to continue with his experiments, technical staff had to be hired. Henry Jameson Davis, Marconi's cousin and one of the company directors, took charge of their recruitment relying on his contacts in the London engineering community.

Although there was no theory to guide the design of equipment and installations, and it was by no means clear on what scientific principles wireless telegraphy was based, a basic understanding of electrical technology and a sound knowledge of traditional telegraphy instrumentation were among the qualification requirements sought in the selection of employees. It was no coincidence that some of the first technicians were hired on the basis of the skills they had acquired working for telegraph companies or, as in the case of George Kemp, for the General Post Office.

Many of the apparatus components were purchased from London-based manufacturers of electrical equipment, but others had to be adapted to the particular functions required by the system; some, in particular the

4 Oliver Lodge, "Improvements in Syntonized Telegraphy Without Line Wires", UK patent no. 11,575, 1897.

5 Jackson was later to be appointed Director of the Royal Naval War College and Chief of the Admiralty War Staff; he was also First Sea Lord in 1915-16. On his research on wireless telegraphy see Pocock, Garratt 1972. As for Kennedy and Baden-Powell, see respectively "Obituary" 1915 and Pritchard 1956.

coherers, had to be produced with specific characteristics. It is therefore not surprising that one of the first employees was an instrument maker, John Cave, and that because of his expertise in the technique of glass-blowing he was entrusted with the production of coherers.

Among Marconi's closest collaborators were some young graduates from higher education institutions: in particular Edward Glanville, James Erskine Murray, and Andrew Gray. The first studied physics at Trinity College Dublin, where he had been a student of George Fitzgerald (Sexton 2005); Murray had been a student of Kelvin at Glasgow University and subsequently a researcher at the Cavendish Laboratory in Cambridge (*Proceedings of the Royal Society of Edinburgh* 1928). As for Gray, he had graduated from the Royal Technical College in Glasgow and had then worked at the West India and Panama Telegraph Company ("Andrew Gray, Chief Engineer MWTCo" 1916) **[fig. 1]**. Others were students who had attended physics and electrical engineering courses offered by London-based technical schools. Paradoxically, a good number of them had been students of Silvanus Thompson, professor of electrical engineering and principal of Finsbury College, who was a staunch opponent of Marconi. However it must be pointed out to his credit that Thompson was one of the best teachers of that new discipline, not only for his skills as a lecturer and demonstrator, but also as a source of inspiration for the professional careers of his students (Arapostathis, Gooday, Ash 2021).

It is worth noting that an assistantship was not a formally recognised job position within the MWTC employment structure. The task of the first employees was to collaborate with Marconi, who was the technical director of the company, in his experimental work. The qualification as assistants became the informal occupational description of the members of that group of recruits.[6] When their number gradually increased – initially operators for the growing number of wireless telegraphy stations, then from the end of 1898 workers for the Chelmsford factory – a selection process was put in place to single out those with not only the skills, but also the stamina and determination required in order to keep up with the daunting task of supporting Marconi's extraordinarily intense research effort.

The common characteristic of almost all the assistants, with the exception of Kemp and Cave, was definitely their young age; it was also their willingness to participate in an adventure at the edge of technological impossibility. In order to play that role it was necessary to learn from practice, even leaving aside some of the knowledge acquired in their previous electrical engineering experience. The premise was clear: the truly relevant instruction was gained working side by side with Marconi at the experimental stations where the wireless telegraphy equipment was assembled and tested. Training consisted of learning not only to set up and use the apparatus, but also to build some of the components: relays, capacitors, resistors, aerials and also coherers.

Marconi's goal, therefore, was not only to instruct competent wireless operators, but also to enable them to acquire the practical know-how and experience necessary to contribute to the improvement of the new technology, essentially by trial and error. The way in which research was carried out had a particular characteristic: experiments were conducted using instruments and apparatus designed for field tests. The functioning of the entire transmitting and receiving apparatus, including the power supply devices and antennas, could only be examined in those operating conditions. Therefore the laboratories were the wireless stations, both the permanent ones built by the MWTC along the British coast, and

6 The term 'assistant' appears not only in public and private Marconi publications, but also informally in the MWTC documents referring to staff and their movements: OBL MSS Marconi 639-40; OBL MS 654.

Figure 1 Staff of the Marconi Wireless Telegraph Company, 1898. From top to bottom, left to right: A.A. Cahen, J. Erskine Murray, P.W. Paget, G.S. Kemp, T Bowden, G.L. Bullocke, G. Marconi, H. Jameson-Davis, W.W. Bradfield, W.R. Elliot, E.E. Glanville, C.E. Rickard, J. Cave; H.W. Allen (secretary of the MWTC). George Kemp, "Extracts from Diaries, 1897-1898", OBL Marconi Archive, MS Marconi 89

the temporary ones set up on land and on ships, for the purposes of demonstration to public and private agencies interested in the new communication technology.

To carry out this kind of activity the assistants had to be able to work remotely, following Marconi's instructions. They were expected to be able to solve problems, make decisions with regard to adjustments and modifications also in the absence of direct instructions from their technical director. Moreover they were expected to describe accurately their work and to report to Marconi on the results they obtained in the course of the tests. Of utmost importance, therefore, was the capacity of the assistants to analyse and accurately report the results obtained from applying modifications to the system, both those requested by Marconi and those that they themselves deemed appropriate based on their own experience. Last but not least, the tasks that they were expected to perform were often to be carried out in challenging environmental settings, for example when the stations were located on lightships, and the workload was heavy; therefore the job was acceptable only to highly motivated people.

It should be kept in mind that the distance between the stations did not allow the participants in the experimental activities to keep in direct contact. The reports prepared by the assistants, which the company for obvious reasons wished to remain confidential, were sent by mail. It is precisely this extraordinarily rich mass of correspondence, kept in the Marconi Archives at the Bodleian Libraries in Oxford, that serves as the primary source for the analysis of the role they performed in their collaboration with Marconi.

3 From the Coherers to the Jiggers

In the case of the coherers Marconi had already availed himself of the observations and tests carried out by his assistants when, after the incorporation of the MWTC, he engaged in the attempt to improve the effectiveness and reliability of that first kind of detectors of wireless signals.[7] The 1896 patent gave a brief description of the coherers; however their production, in particular the components of the metallic filings positioned between the electrodes and their methods of preparation, remained known only to Marconi and his assistants.[8] John Cave and his brother Robert were hired to undertake that very task, due to their experience as instrument makers; however, the manual filing of fine metal grains for the coherers was often the first occupations assigned to the new recruits.[9]

The diaries and correspondence of Kemp, Cave and the other assistants, are a testimony to their contribution to the development of that first and notoriously troublesome type of detector, and also to the determination with which they carried out that task. The communications sent to Marconi report their observations on the results obtained using different types of metal filings and modifying the ways in which the coherers were

7 See the reproductions of these devices in Casonato, Spada, *infra*.

8 Guglielmo Marconi, "Improvements in transmitting electrical impulses and signals, and in apparatus therefor", UK patent no. 12,039, 1896.

9 Degna Marconi (1993, 53) gives a vivid description of how the manufacture of the coherers became a sort of 'rite of passage' for the new recruits. The young man who was assigned that task on his arrival in Poole in 1899 was Harry M. Dowsett, who was later to become the principal of the MWTC School of Wireless Telegraphy and performed administrative duties until his retirement. A similar experience is described by Charles Franklin in OBL MS Marconi 682, "Notes by Franklin", 6.

connected to other components of the receivers. They also endeavoured to put forward explanations for the different outcomes of their tests and to suggest alternative solutions. This experimental work on the coherers continued even when the Chelmsford factory was opened in 1898 and the industrial production of wireless equipment began, with John Cave being appointed foreman of the coherer department.[10]

The empirical research on tuning and the development of the jiggers is an equally valid example of the same collaborative effort, and the contribution offered by the assistants was just as important. In the early months of 1898 the first attempts had already begun to revise the system in such a way as to allow a certain degree of selectivity, while at the same time increasing the distance of transmission without raising the height of the antennas.[11]

In seeking a solution, Marconi began with what seemed like a clear opposition between two options. On the one hand there was his original arrangement – with the antennas of the transmitting and receiving devices connected to earth passing respectively through the circuits of the spark gap (the electromagnetic wave generator) and of the coherer. This gave good results in terms of transmission distance, but did not allow for tuning. On the other hand there was the solution adopted by Lodge in his patent on syntonic telegraphy which used a closed transmission system, that is to say not connected to earth. This solution yielded satisfying results but only for short-range transmission.

What Marconi chose was a sort of compromise. Very briefly, in the arrangement described in the first 1896 patent the receiving and transmitting antennas were respectively connected to the coherer and the radiator, and from these to earth. In the new provision, the induction coils that acted as frequency transformers (the jiggers), were inserted between the closed circuits of the receivers and transmitters, and the antennas connected to earth. Once again, it was a solution developed gradually and without a well-defined theory to guide the experimental process; in fact, at that stage the instruments capable of measuring the wave lengths produced by the transmitters were not yet available.[12] As already observed, and as was plainly admitted by Marconi himself, his attempts to improve the system advanced through trial and error.[13]

In the patent submitted to the London Patent Office in June 1898, the first in which the jiggers were described, there was no mention of the tuning between transmitting and receiving apparatus; the aim, as it was stated, was to reduce the interference caused by atmospheric disturbances, and at the same time to increase the signalling distances.[14] The new arrangement, which was at that stage adopted only for the receivers, involved inserting an induction coil into the receiving system in such a way as to connect inductively the circuits of the coherer and of the antenna: the primary winding of the coil was connected to the antenna, the secondary one to the coherer. Different types of coils were described in the patent, which varied in the dimension of the support on which the primary and

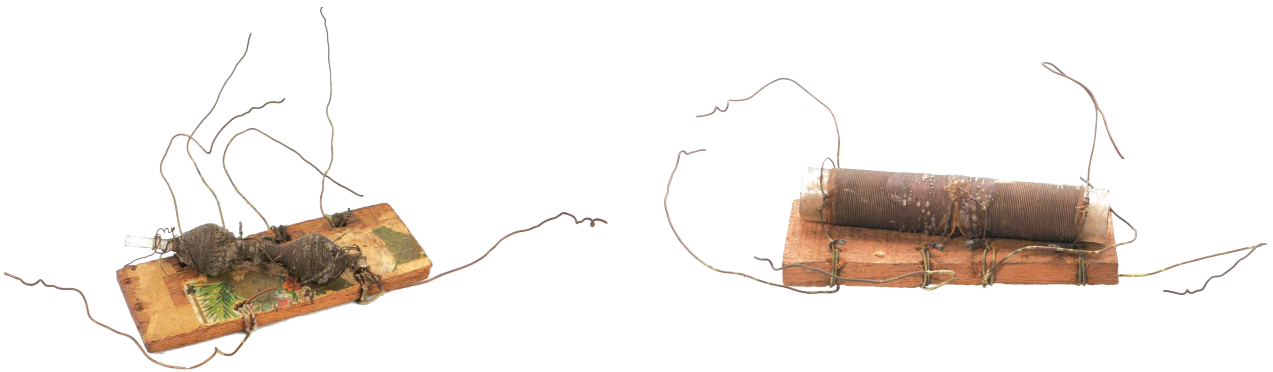
10 A substantial part of the correspondence between Marconi, Cave and other assistants is filed in OBL MS Marconi 178.

11 One of the first references to the research in progress appears in Kemp's diaries, in which the term jigger is used for the first time (26 October 1898). "Extracts from the diary of G.S. Kemp, 1897-1898", OBL MS Marconi 89.

12 Such an instrument was invented by Fleming in 1904. John Ambrose Fleming, "Improvements in instruments for the measurement of wave lengths in wireless telegraphy", UK patent no. 27,683, 1904.

13 For an in-depth analysis of the syntonic system developed by Marconi see Hong 2001, especially chapter 3.

14 Guglielmo Marconi and the Wireless Telegraph and Signal Co., "Improvements in apparatus employed in wireless telegraphy", UK patent no. 12,326, 1898.



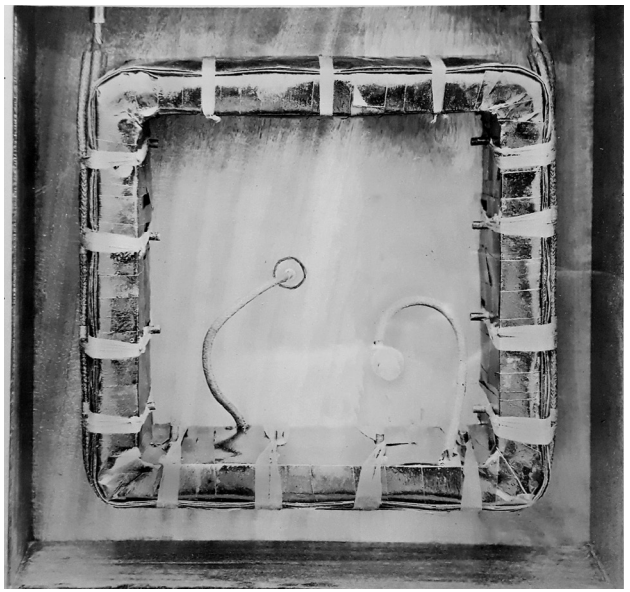
Figures 2a-b Two different examples of receiver jiggers with a one-layer spool and coils of secondary windings used by the Marconi Company and probably produced by the MWTC in Chelmsford, 1898, inv. 1923-434/4, inv. 1923-434/3, Science Museum Group, London. © The Board of Trustees of the Science Museum

secondary were wound, the number of layers, and the length of the wires. The jiggers were small glass tubes between 2 and 4 cm long and approximately 1 cm in diameter, around which was wound the primary circuit. This consisted of a silk-covered copper wire, which varied in diameter from 0.45 mm to 0.12 mm, and was generally wound in one or two layers. The secondary winding was wound above the first, from which it was separated by insulating material and consisted of a thinner silk-covered wire, which varied in diameter from 0.19 mm to 0.12 mm **[figs 2a-b]**.

Other models of receiver frequency transformers were tested in 1899, this time without specific reference to the nature of the improvements obtained with regard to the quality of communication. The two patents resulting from those tests described new forms of jiggers, with changes in the shape and the number of turns of the windings of the coils as well as the thickness and length of the wires. In the second patent in particular, a new fundamental detail was introduced: it was stated that the best tuning results were obtained when the length of the coil wires were in proportion to the length of the transmitting and receiving antennas.[15]

Research continued in the early months of 1900 and in April, again in the name of Marconi and his company, a new patent application was submitted to the Patent Office, the historical 7777. This time the objective was clearly stated in the first lines of text, namely, not only to increase the transmission distances, but also to “so control the action [of the apparatus] as to cause intelligible communications

15 Guglielmo Marconi and the Wireless Telegraph & Signal Co., “Improvements in apparatus employed in wireless telegraphy”, UK patent no. 6982, 1899; Guglielmo Marconi and the Wireless Telegraph & Signal Co., “Improvements in apparatus employed in wireless telegraphy”, UK patent no. 25,186, 1899.



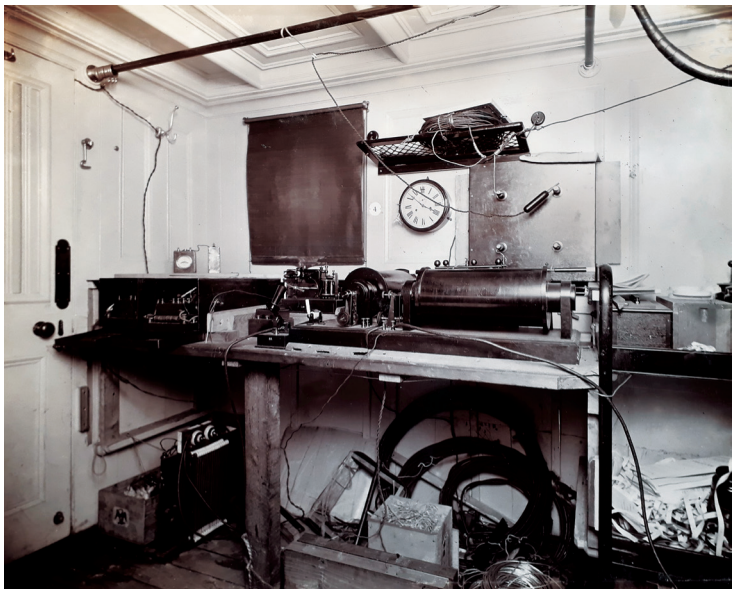


Figure 3a Jigger inside the box. OBL MS photograph b61

Figure 3b The radiotelegraphy cabin on board the ship *Philadelphia* in 1902. The box containing the jiggers hung on the wall. OBL MS photograph c253

to be established with one or more stations only out of a group of one or more receiving stations”.[16] The objective was achieved by inserting frequency transformers into the transmitting circuits as well; the model of transmitting jigger described in the patent is shown **[fig. 3]**.

In reality, the attempts to improve the system continued at a relentless pace until the submission of the complete specification of the 7777 patent in February 1901 (see p. 82).[17] Just as in the past, in the preparation of that document Marconi trusted in the advice of the experts who had already assisted him with the first patent, the Carpmael patent agents and John Fletcher Moulton, and in Fleming’s guidance (Guagnini 2002). At that point the road towards combining tuning with long-distance transmission was wide open, reinforcing the plan to cross the Atlantic by wireless which Marconi was already setting in motion.

16 Guglielmo Marconi and the Wireless Telegraph & Signal Company, “Improvements in apparatus for wireless telegraphy”, UK patent no. 7777, 26 April 1900. In the patent text the use of the term ‘syntonic tuning’ as employed by Oliver Lodge is scrupulously avoided. The term used is resonance.

17 Marconi himself described the long series of laborious passages leading up to the so-called ‘four-seven’ patent in Marconi 1901.

4 The Role of the Assistants

As pointed out above, the laboratories where the experimental work was carried out were the installations set up by the MWTC for tests and demonstrations. From September 1898 the main station became the Hotel Haven in Poole, on the southern coast of England; other permanent shore stations were located at the Needles, on the Isle of Wight, and in 1899 at the Sandrock Hotel, Niton, on the southern coast of the Isle of Wight. In addition to those installations, several temporary stations, both on land and on shipboard, were specifically set up for the numerous demonstrations requested in that period by potential clients and public bodies. At the time the principal temporary stations were South Foreland (near Dover, on the English Channel) and the East Goodwin lightship (notoriously the most inhospitable of the locations due to the frequently appalling weather conditions) established at the eastern entrance to the English Channel for tests requested by Trinity House, the private company responsible for the monitoring of lighthouses along the British coastline; and Wimereux station, fitted for the demonstrations offered to representatives of the French government. Of particular importance, with regard to the experiments on the syntonic devices, were the stations set up in July 1899 on board the battleships *Alexandra*, *Europa* and *Juno*, during Royal Navy ship manoeuvres; and those installed in 1900 in Germany on board of the Borkum lightship and at the Borkum lighthouse, for communications with ships of the Norddeutscher Lloyd Steamship Company. Just as important again were the tests carried out in November 1899 on board of the transatlantic liner *St. Paul*, which was sailing from the United States to England.[18]

The tests and demonstrations carried out in those stations, all of them staffed with Marconi's most trusted collaborators, offered extraordinary opportunities for advancements in the design of the system. Clearly Marconi issued detailed guidelines for the assistants' work, but because they were operating far from the Poole and Chelmsford bases, they had to be capable of exercising a certain degree of autonomy in making decisions relative to the problems encountered while conducting the tests. Their responsibilities involved not only varying the configuration of the components of the system, including the antennas, but also rectifying them when the results were not satisfactory. With particular regard to tuning, it was their task to adjust the characteristics of the jiggers, for example varying the number of layers and the shape of the windings, as well as the thickness and length of the small tubes around which the wires of the primary and secondary wires were wound.[19] Adjustments were often required also for other components of the system that had to be balanced in such a way as to achieve the goal of resonance, among them condensers, resistances, relays and chocking coils.[20]

Given that most of this work was carried out remotely, and that the reports and evaluations on the results of the

18 In November 1899 Bradfield, Rickard, Bowden, and Denshaw accompanied Marconi on board the *St. Paul*. In the same year those assistants together with Bullocke and Dowsett participated in the Royal Navy tests alongside Marconi.

19 For example, in a letter to Marconi on 24 July 1900, Bradfield, who was in charge of setting up and operating the Borkum station, observed that "the experiments here transformed me into a first-class jigger winder. I must have tried quite 50 altogether" (Copy-letter books, OBL MS Marconi 182).

20 See correspondence in Copy-letter books, 1900-03, OBL MSS Marconi 182-3.

tests had to remain as usual strictly confidential, communication once again was confined to written correspondence.[21] Fortunately for us, one might say, because the result is an extraordinary repository of primary sources for an in-depth study of the transition from the early forms of frequency transformers to the production of the first syntonic apparatus. They allows us to examine how the assistants, as they became progressively more involved in the experiments on receiving and transmitting jiggers conveyed to Marconi not only accurate descriptions of how the tests were carried out, but also their own analysis of the results and recommendations on how the system could be improved. The correspondence reveals how, and to what extent, the assistants themselves played an active role in the identification of the solutions which were described in the complete specification of the 7777 patent filed in April 1901, and in the further developments of the research on tuning.[22] Among the assistants initially involved in the syntonic tests along with Kemp (whose diaries are a most detailed source of information also on this phase of Marconi's experimental work) were Bradfield, Bullocke, and Cave. From May 1898 Elliott, Paget, Rickard, Cahen, Murray, Bowden, and Lockyer joined the group.[23] As the programme of test and demonstrations intensified after 1901, new recruits joined the team of the assistants.[24]

The skills and vigorous commitment to work of these collaborators were of fundamental importance; thanks to their support Marconi and his company were able to convince potential clients that the tuned system, in which the jiggers were one of the main components, was the solution to selective communication. It should however be kept in mind that even when the tuned system was adopted in all the MWTC installations, the effective use of these devices required a considerable amount of skill and know-how on the part of the operators. As Fleming observed in 1900, drawing on his own direct experience,[25] and Sungook Hong correctly confirmed, tuning as it had been developed in that first pioneering phase was not a science but an art: "Coping with syntony required technical rather than mathematical skills. Marconi, with his jiggers, was the first to master it" (Hong 1990, 96): that is to say, obviously, Marconi and his collaborators.

21 Confidentiality was explicitly required in the employment contracts. The protection offered by patents could not guarantee that information about the construction procedures would remain inaccessible to potential competitors; it was equally important to prevent the circulation of news about the results of the experiments.

22 Copy-letter books, 1901-03, OBL MSS Marconi 182-3.

23 In November 1899 Bradfield, Rickard, Bowden, and Denshaw accompanied Marconi on board the *St. Paul*. In the same year those assistants together with Bullocke and Dowsett participated in the Royal Navy tests alongside Marconi.

24 Two particularly rich documentary sources regarding the tests carried out by the assistants on syntonic tuning as well as on long-distance communication are OBL MS Marconi 188, which contains the correspondence between Marconi and Entwistle, manager of the Poldhu station from 1901 to 1905; and OBL MS Marconi 197, which contains the correspondence and reports of other assistants, most notably the experiments carried in 1902 by St. Vincent Pletts on transmitting jiggers at the Frinton Station near the headquarters of the MWTC; and Woodward's worked at the Broomfield Rd Station, London, in 1904.

25 "Although Easy to Describe, It Requires Great Dexterity and Skill to Effect the Required Tuning [with Marconi's jigger]" (Fleming 1900, 49).

5 From Experimentation to Production – and Beyond

Based on this prolonged and intense experimentation, the production of frequency transformers began at the Chelmsford factory from 1901. Three types of jiggers, marked with a code and intended for receiver apparatus, were initially produced for sale: model 112, model 132 and model 268, to which corresponded antenna of differing lengths. These were the models used by the 32 devices supplied to the Royal Navy in 1900 **[fig. 3b]**.[26] But it was a first step: even after the first tuned apparatus began to leave the factory, research on frequency transformers continued with undiminished intensity. The aim was not only to improve simultaneous transmission and selective tuning, but also to design the kind of jiggers required for the high-power transmitting stations that were being planned for increasingly long-range transmission – most notably for transatlantic communication. When a new form of frequency transformer designed by Fleming did not prove successful, Marconi went back to developing his own model of jigger.[27] He did so again in collaboration with his well-established group of trusted and experienced assistants – in particular Richard Vyvyan and William Entwistle. The former was a graduate of Faraday House, one of the most prestigious (and costly) London schools for training of electrical engineers, who joined the MWTC after a working experience at Ferranti Ltd. Entwistle had attended electrical engineering courses at the Chelsea Polytechnic in London. Both of them were among Marconi's closest collaborators in the construction and management of the transatlantic stations of Poldhu and Glace Bay.[28] As for the further development of tuned devices, it was Charles Franklin in 1907 who, on behalf of the MWTC, designed and patented what would become the standard equipment for frequency selection in wireless telegraphy, namely the multiple tuners.[29]

6 Conclusion

The role of the group of assistants who joined the MWTC in the first decade of its activity did not remain limited to strictly technical tasks. From 1910 onwards, after their involvement in experimental work and in the creation of a rapidly expanding network of company installations, many of the assistants took on administrative and managerial positions within the company, and retained them until the very end of their working life. Kemp and Paget in particular were often called to Marconi's side at public events to celebrate his pioneering role in the development of wireless telegraphy. Gray, who had already been made chief of staff in 1904, was subsequently appointed MWTC head engineer and remained in that capacity until his retirement in 1931. Many other assistants were assigned to administrative positions: for example, Bradfield, the technical manager of the American subsidiary, was

26 Henry W. Allen, MWTC secretary, to Marconi, 1 November 1900, OBS MS Marconi 245.

27 For an analysis of the abandonment of Fleming's frequency transformer and the return to Marconi's model see Hong 2001, 76-9.

28 Both Vyvyan and Entwistle are among the assistants that Marconi mentions and thanks in "The Progress of Electric Space Telegraphy" 1902, 208.

29 Charles S. Franklin and MWTCo, "Improvements in receiving apparatus for wireless telegraphy", UK patent no. 12960. Franklin was the author of 65 patents, most of them held jointly with the Company. Other assistants were authors of patents applied for on behalf of the MWTCo; among them Round, Gray, Entwistle and Dowsett.

promoted to the Board of directors of both the MWTC and the Marconi International Marine Company; Vyvyan was the chief engineer for the construction of the most important MWTC radiotelegraphy stations abroad; and Dowsett was entrusted with the position of research director.

As the initial group of collaborators gradually distanced itself from direct involvement in experimental activity, other new recruits joined in. Marconi, in fact, continued to select among them his own personal staff; among those who maintained a high profile as researchers well into the interwar period were two of the assistants mentioned in the first part of this essay: Round (Baker, Hance 2010) and Franklin (Symons 2004).

However, it is important to bear in mind that in the period leading up to 1914, there was no research unit officially set up within the MWTC; that responsibility remained totally under Marconi’s direct control. The consultancy contract offered to Fleming, which lasted from 1899 to 1914, was definitely a substantial investment for a company technologically very ambitious but still in its early phase of development; and yet, although he carried out his job with much energy and determination, he found it hard to fully integrate into Marconi’s project. As for the assistants, they remained strongly tied to the man they saw as their leader – to Marconi rather than to the MWTC itself. As a result, the nature and worth of their contribution becomes apparent only through the direct relation they established with their technical director. It remains to be ascertained – and it is an aspect that deserves to be considered from a historical perspective – to what extent this strong vertically structured personal relation constituted a limiting factor in the development of a more effective research organisation within the MWTC, especially when by the 1910s the competition of rival companies began to challenge its technological leadership in the field of wireless communications.

Table 1 Qualification and chronological order of the hiring of assistants

1897	
Bradfield, W.W.	Finsbury Technical College, London
Glanville, E.	BSc King’s College, Dublin
Bullocke, G.L.	King’s College, London
Cave, J.	Scientific instrument maker
Kemp, G.S.	Royal Navy and General Post Office
1898	
Elliott, W.R.	
Paget, P.W.	Finsbury Technical College, London
Rickard, C.E.	University College, London
Cahen, A.A.	BSc Central Institution, London
Erskine Murray, J.	BSc Glasgow University, research at the Cavendish Laboratory, Cambridge
Bowden, T.	Finsbury Technical College, London
Lockyer, C.J.	
1899	
Cave, R.F.	Scientific instrument maker
Densham, W.	General Post Office
Gray, A.	BSc Glasgow University, West India and Panama Telegraph Company
Dowsett, H.M.	Finsbury Technical College, London; British Thompson Houston Company, Ferranti Company
Stacey, F.S.	Finsbury Technical College, London
Franklin, C.S.	Finsbury Technical College, London
Pletts, J. St Vincent	Central Institution, London
Newman, F.	Eastern Cable Company
Stacey, F.S.	Finsbury Technical College, London
Woodward, P.J.	Finsbury Technical College, London
1900	
Hepworth, W.C.P.	South London School of Telegraphy
Hobbs, T.E.	General Post Office
Vyvyan, R.N.	Faraday House, London; Ferranti Company
1901	
Ashley, L.N.	Crompton Dynamo Company
Entwistle, W.S.	
Ginman, A.H.	
Tyler, E.G.	Battersea & Chelsea Polytechnic, Kincaid Waller & Manville (consulting electrical engineers)
1902	
Bangay, R.D.	Finsbury Technical College, London
Burrows, F.E.	Central Institution, London
Round, H.J.	Royal College of Science, London

* The selection of the names is based on the information provided by the MWTC recruitment lists cross-referenced with mentions in the documentary sources of the Marconi Archive, in particular the correspondence in OBL MSS Marconi 182-3; 188. Information on training and work experience is not available for all the assistants.

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This pamphlet, housed in the Biblioteca Museo Nazionale Scienza e Tecnologia Leonardo da Vinci, documents the relations between the Italian government, Marconi's Wireless Telegraph Company (MWTC) and Marconi himself at the beginning of World War I. There is no mention of the author on the cover, just an institutional heading: "Ufficio Marconi, via del Collegio Romano, N. 15, Roma". The consultation of national and international catalogue portals reveals that only ten other copies exist in Italy, in addition to the one at the Museum. One copy is located outside Italy at the Marconi Archives in Oxford (OBL MS Marconi 212). The seemingly impersonal and institutional reporting style of the publication actually reflects the deep interconnection between private and public interests that was established at the beginning of the 1900s during the institutionalisation of a new means of communication namely 'wireless telegraphy'. In those years Marquis Luigi Solari (1873-1957) headed the Ufficio Marconi. Historically recognised as the official biographer of the inventor, Solari was an officer in the Regia Marina Italiana (Royal Italian Navy) and also the manager of the business affairs of the English company in Italy. In contrast to other countries, the MWTC did not have a subsidiary branch in Italy at the time (see Pietrangeli, *infra*). It was Solari who managed the business relations on behalf of Marconi, who wished to maintain a personal connection with his home country (Raboy 2016, 211), as evidenced in similar material for commercial and institutional communication published by the MWTC in England (to be located in OBL MS Marconi 1212, 1391-2). The Biblioteca Museo Nazionale Scienza e Tecnologia Leonardo da Vinci also preserves a pamphlet containing an interesting interview with Solari in which, from the light and confidential tone, we can appreciate the traits of an enthusiastic promoter of the Marquis' new technology (Ghelli 1906).

How Marconi Influenced Italian Telegraphic Policy
The Berlin Conferences of 1903 and 1906

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1 Introduction. The International Dimension of Wireless Telegraphy

Wireless telegraphy came into being at the end of the nineteenth century and, in many aspects, was immediately perceived as a means of international communication. From a political point of view, telegraphic waves could not be confined to national borders meaning international regulations were drawn up relatively quickly, so much so that international legislation often preceded national laws (Giannini 1920, 14). Moreover, wireless technology was seen by governments as an instrument for international communication, and its control became vital for countries such as the United Kingdom, Germany, France, and later the United States (Headrik 1991). From an economic point of view, large private companies, such as the British Marconi Company, the German Telefunken and the French Société Générale, competed to acquire dominant positions firstly in the European markets, then globally. The wireless telegraphy market was, in other words, supranational. Lastly, wireless technology was international also in terms of users. Amateur radio enthusiasts, whose importance grew in many European countries and the United States in the 1910s, were focused on communicating with each other and listening to public content such as transmissions from the Eiffel Tower (Rikitianskaia et al. 2018).[1]

This chapter is a revision of Balbi 2012.

1 The transmissions broadcast from the Eiffel Tower were bulletins of telegraphic information that became popular among expert users at the beginning of the 1900s (Balbi 2017, 3). The symbolic role of the tower in European wireless telegraphy, which has today become the symbol of Paris, and France too, is clearly explained in Rikitianskaia 2024.

One of the indications of the international dimension of wireless technology could be the initial attempt to draw up legislation at an international level. Two conferences organised in Berlin in 1903 and 1906 were strategic for at least two reasons. On the one hand, a series of common and international rules were established regarding wireless communication, and a path was laid out for a shared understanding of this new medium. On the other, the central theme of these conferences was the political and economic attempt to break down the monopoly held at the time by the Marconi Company, a British company mainly linked to the United Kingdom and Italy (Tomlinson 1945; Hugill 1999) [fig. 1].[2]

Perhaps the most important strategy was the so-called 'non-intercommunication policy'. For many reasons (political, economic, technical, patent protection, etc.), the Marconi Company refused to communicate with other wireless companies set up in the meantime. This created 'diplomatic' misunderstandings. For example, when the Kaiser's brother was returning to Germany after a trip to the United States, he was unable to communicate with either side of the Atlantic because he was travelling aboard a boat equipped with Slaby-Arco apparatus and the Marconi stations refused to communicate with the ship (Douglas 1989, 119). The non-intercommunication policy turned out to be not only a commercial strategy adopted by a private company, but also acquired a political importance. It was seen by the United States, France and Germany as an attempt by the United Kingdom to maintain its monopoly on telecommunications which it had achieved by using underwater cables. Obviously, these countries aimed to free themselves from British control of communications (Friedwald 2000, 441-62).

Other than the United Kingdom, there was another nation that, for different reasons, was standing against other countries to protect Marconi's international monopoly: Italy. Drawing on some unpublished sources, this chapter seeks to identify the political, economic, technical and social reasons that compelled, or in some cases obligated, Italy to adopt a strategy of diversification and isolation, placing the country at the centre of the international debate on wireless communication.

2 Italy at the International Conferences in Berlin, 1903-06

In early August 1903 the *Preliminary Conference on wireless telegraphy*, opened in Berlin with delegates coming from Germany, Austria, Spain, the United States, France, Hungary, Russia, the United Kingdom and Italy [fig. 2].

The meeting was organised by Germany to discuss the regulation of the international wireless telegraphy market and to facilitate competition between various private companies, instead of allowing the dominant positions of a few companies to crystallise. Germany and France, who supported large wireless enterprises such as Telefunken and Compagnie générale de télégraphie sans fils, maintained that it was too early to determine the superiority of one technical system over another: it would hinder technical innovations and go against fair competition, as can be read in the *Documents de la Conférence préliminaire concernant la télégraphie sans fil* (1903, 15-16; 37; 47). The United Kingdom and Italy, on the other hand, protected the dominant position and Marconi's economic interests. Italy, in particular, made a notable diplomatic effort. The most effective delegate was the marquis and

2 The Wireless Telegraph and Signal Company Ltd. in 1897, subsequently becoming Marconi's Wireless Telegraph Company Ltd. in 1900, and commonly referred to as the Marconi Company.

Figure 1
"On the seven seas Marconi gives unrivalled wireless service". Newspaper cutting with advertisement in 1919 from the Marconi International Marine Communication Co. Ltd, important maritime branch of the Marconi Company, taken from the company's advertising register. Oxford, OBL MS Marconi 1390

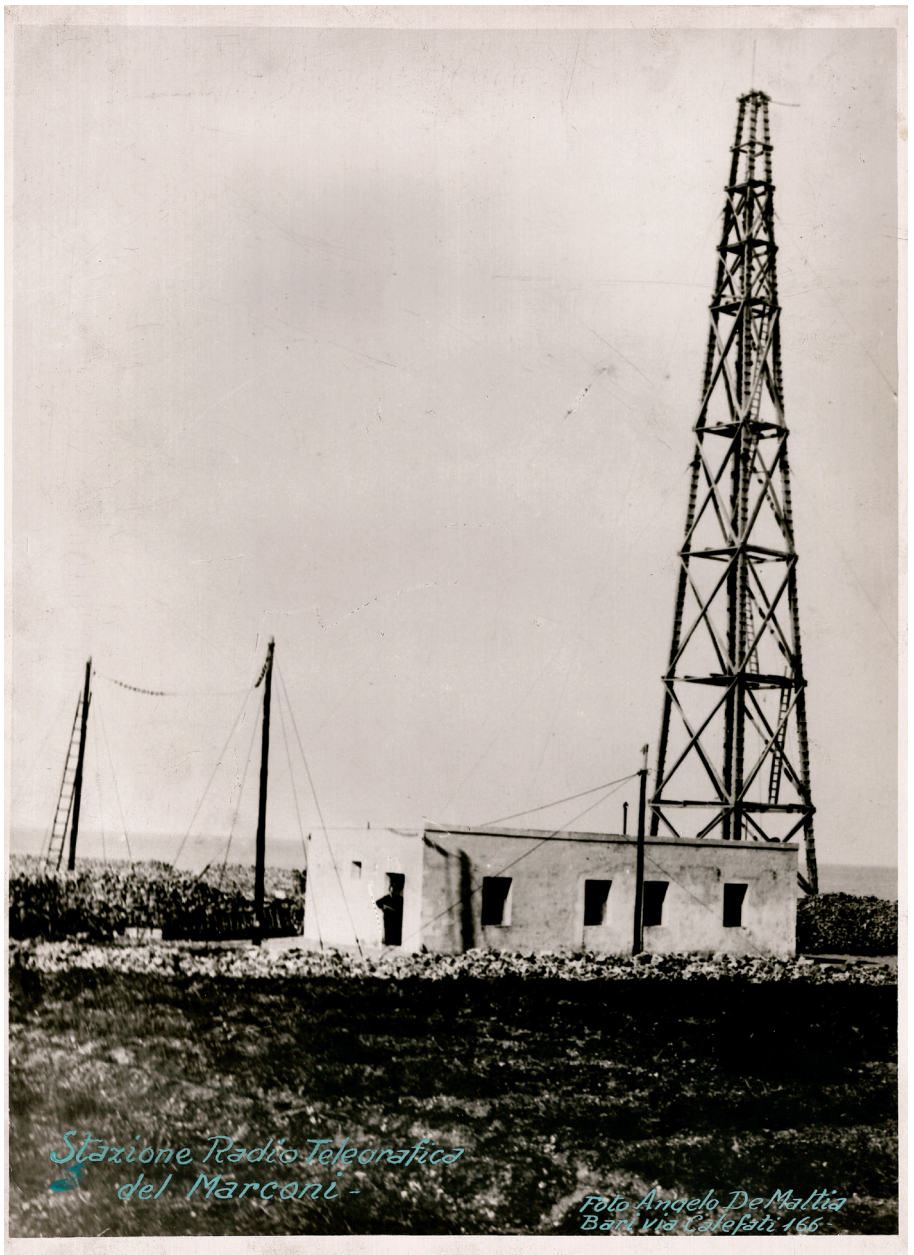


Figure 2
"Marconi Radiotelegraphic Station, Bari. The 6th external photo depicts a magnificent landscape within the middle of which the whole Station can be viewed, with a large antenna on one side and two other smaller ones at the back, which [sic] are for the transmission of Hertzian waves", reads a handwritten note on the back of this undated image, present along with others in the Museum Archive. A stamp by the author, Angelo De Mattia, informs us that he is a Specialist in photography of Apulian monuments"
(ASMUST, Archivio Fotografico)

naval officer Luigi Solari, who at that time worked at the Ministry of the Navy and was appointed in 1903 by the Ministry of Post to manage the commercial wireless stations. He argued that a free market would provoke many difficulties due to fragmentation and the lack of standardization of wireless telegraphy systems at practically every level: organisational, military, scientific and technical, given the presumed incompatibility between the various systems. According to Solari these difficulties would have forced the international community to temporarily chose one "system only" (*Documents* 1903, 21-2). The 'million dollar' question was: which one? Obviously the one that

> At the present proves itself to be the best as regards range of communication, as regards the development of the international service, and as regards efficient organization. […] On the choice of this system, I desire to declare that I have not an incontrovertible preference for a given system. I have followed, it is true, the magnificent experiments of Mr. Marconi across Europe and across the Atlantic. […] But if another system offered advantages superior to those afforded by the Marconi system, I would be very happy to request the new inventor to put his work at the disposal of my country. (*Documents* 1903, 22)

Using a rhetorical trick, Solari was implicitly suggesting that Marconi's system should be the only system selected by the international community because, at the time, it was the only one capable of crossing the Atlantic and had a strong and extensive, international organisation.

A second Italian delegate, Fedele Cardarelli, Chief of Division of the Ministry of Post, maintained that, to guarantee technological efficiency a designated commission would have to evaluate the equipment quality at the various companies and, after this evaluation, chose the most advanced system (*Documents* 1903, 24-5). Another rhetorical device aimed at promoting Marconi's equipment, at the time considered to be the most efficient.

The third and fourth Italian delegates, Rear Admiral Carlo Grillo and Commander Quintino Bonomo, worked for the Ministry of the Navy. They sustained that a wireless telegraphy system in competition with various private companies, and thus with differing apparatus and systems, would not work. It was not treated as a secondary opinion because at the time the Italian Navy was one of the institutions, if not the institution, that had carried out the greatest number of experiments with wireless telegraphy systems (*Documents* 1903, 66). The fact that the military ministries, and the Navy in particular, were aiming to promote and establish monopolies, instead of supporting fair competition, had long been a characteristic of the Italian approach to telecommunications. The War and the Navy Ministries preferred monopolies because it was easier to manage them in case of conflict and, for the same reason, they supported Italian monopolies as they were more reliable. In the mid-1800s the Ministry of the Navy had already facilitated the establishment of a monopoly on undersea cables owned by Pirelli (Fari 2006). In 1903, in Berlin, it backed Marconi for the same reason.

The United Kingdom proposed adopting an intermediate solution, requesting compensation for all the companies that had already set up a commercial system, like the Marconi Company, "for example applying a higher fee for every communication exchanged with a ship equipped with a different system installation" (*Documents* 1903, 25). The Italian delegates proved to be rather ambivalent regarding this proposal. On the one hand, Solari initially refused to consider compensation as a solution and continued to recommend the single system (26). On the other, Grillo claimed to believe it was "essential to provide compensation to the companies with stations currently in operation" (40). In any case, the preliminary radiotelegraphy conference in Berlin in 1903 was a partial failure

because Italy and the United Kingdom did not ratify the final agreement.

Three years later, again in Berlin, the second radiotelegraphic conference was organised with the participation of many countries. The main topic was once again free communication between ships and ground stations, and on that occasion, the United Kingdom immediately declared itself in favour of intercommunication, regardless of the system applied. In exchange, it asked that some governments be granted the possibility of establishing radiotelegraphic stations that were not required to meet this obligation (50). As a result, Italy was left in an isolated position at this conference due to its policy of refusing intercommunication and, for this reason, it radically changed approach. The Italian delegate Giuseppe Colombo:[3]

> recognises the significance for international relations of the principle of free radiotelegraphic intercommunication between different radio systems. As the Italian government is *obliged* to uphold the conditions agreed with Mr. Marconi and his Company, the Italian delegation is unable to find any other way to propose changes than to find an agreement between the two parties. […] Furthermore it will recommend that the Italian government discuss with Mr. Marconi any eventual changes deemed to be necessary or appropriate for the purposes of reaching an international agreement. (51; italics added)

At the Berlin conferences, Italy acted as the international advocate for the Marconi Company. All the proposals put forward, even those that seemed unrelated, aimed to protect its dominant position, maintain its privileges on the international market and discourage fair competition. Why did Italy adopt this bold and, at the same time, dangerous policy, given that it was leaving itself an isolated position? What were the reasons for putting forward or applying this strategy in the international arena? What were the links between Italy and the Marconi company?

3 I am Marconi your God. Three Strategies of Influence

3.1 Free, But Only Marconi

In February 1901 Guglielmo Marconi offered his patents free of charge to the Ministry of War and the Navy for military use "desiring that *his* Country use his invention *before any other* "as the Ufficio Marconi wrote in 1915 (3, italics added; Giannetto 1995, 19). With the passing of law 127 on 5 April 1903 the Italian Parliament decided to set up an ultra-powerful radiotelegraphic station in Coltano (near Livorno) to communicate with South America and in particular Argentina, where many Italians had emigrated in the previous century. To ratify the law, an agreement was drawn up between Marconi and the Italian government, stating that there would be no attempt to use any

3 Giuseppe Colombo (1836-1921) was a key figure within the Italian scientific, technical and industrial communities, with important institutional (he was among the founders of the Politecnico di Milano, national member of Lincei), political (President of the Chamber in 1899-1900, Minister of Finance in 1891 and of the Treasury in 1896, a senator from 1900) and commercial roles (founder of the Italian Edison Company with which he gave important impetus to the Italian electrical industry) (Cambria 1982).

equipment other than Marconi's for commercial purposes for 14 years.[4] Essentially, a few months before the first Berlin Conference, Italy decided to seal a deal with the Marconi Company, an agreement that was as economically beneficial as it was tyrannical. On the one hand, it could freely use the patents, but on the other it could only use Marconi's devices. The logic of *do ut des* (I give so that you may give) was driving Italian politics, as was also evident in parliamentary debates, when again in February 1903, the clause of non-intercommunication seemed "to pose a serious obstacle to our next radiotelegraphic communications with other European countries"; in any case "considering the indisputable costs incurred by Guglielmo Marconi and his company, namely in freely relinquishing all of his present and future patents to the Italian government, it would seem unjust to associate his equipment with those of his competitors".[5]

This was one of the principal strategies used by Marconi to tie Italy both to himself and his company. On 5-10 May 1904 Guglielmo Marconi signed a new agreement with the Ministries of Posts and the Navy confirming the two cornerstones of his strategy: the Italian government could freely use his patents and even reproduce his instruments (Art. 1), but at the same time the Italian radio stations could only agree to communicate with other stations equipped with Marconi apparatus for a 14-year period beginning on 13 February 1903 (Art. 2).[6]

This explanation can be found in the document preserved at the Museum:

> The Italian government agreed to exclusively use the Marconi system for commercial services (while maintaining complete freedom for military services) and to prevent, except in cases of emergency, commercial communication between its Italian and colonial stations using systems different to Marconi's. This was to ensure that the advantages granted to the Italian government by Guglielmo Marconi did not benefit industries competing with Marconi's own company, industries that had largely infringed upon Marconi's patents. (Ufficio Marconi 1915, 3; transl. by the author)

Marconi, probably aware he was in violation of regulations, defensively described the choice of the Italian government as a free one. We know that this was not the case: it was 'blackmail', or an imposition on a national government, by a company that was international at the time **[figs 3a-b]**.

This agreement was upheld for seven years, and it was only modified on 5 and 9 February 1911. To allow Italy to attend the Radiotelegraphic Conference in London, Marconi permitted both Italian ships to intercommunicate with ships equipped with any apparatus when located in foreign waters and Italian land stations to exchange radio telegrams with French and German ships equipped with apparatus other than Marconi's.[7]

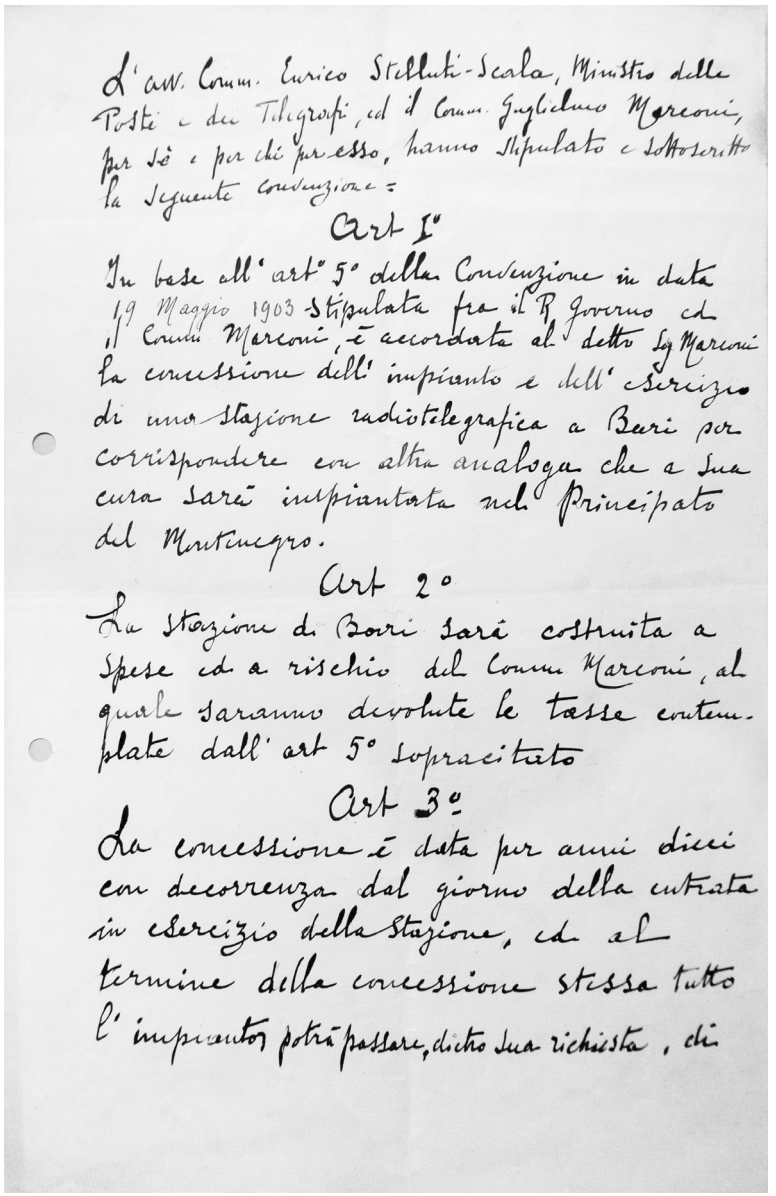
Marconi decided to modify the contract with the Italian government after lengthy negotiations, and in the agreement, he describes his point of view as follows:

4 AP, CD, Legisl. XXI, 2° sessione, *Disegno di legge n. 297, presentato dal Ministro delle Poste e dei Telegrafi (Galimberti) di concerto col Ministro del Tesoro (Di Broglio), Impianto di una stazione radiotelegrafica ultrapotente (Sistema Marconi)*, 14 February 1903, 4-5. See in particular Articles 10 and 14.

5 Italian Parliamentary debates, 20 February 1903, 5703 and 5706.

6 Archivio del Ministero della Marina (hereafter MMA), 1912-13, cart. 283, fasc 1. Regarding this agreement and its influence on Italy's international wireless communication policy, see also Paoloni 2006, 194.

7 MMA, 1912-13, cart. 283, fasc 1.



L'on. Comm. Enrico Stelluti-Scala, Ministro delle Poste e dei Telegrafi, ed il Comm. Guglielmo Marconi, per sè e per chi per esso, hanno stipulato e sottoscritto la seguente convenzione:

Art. 1°

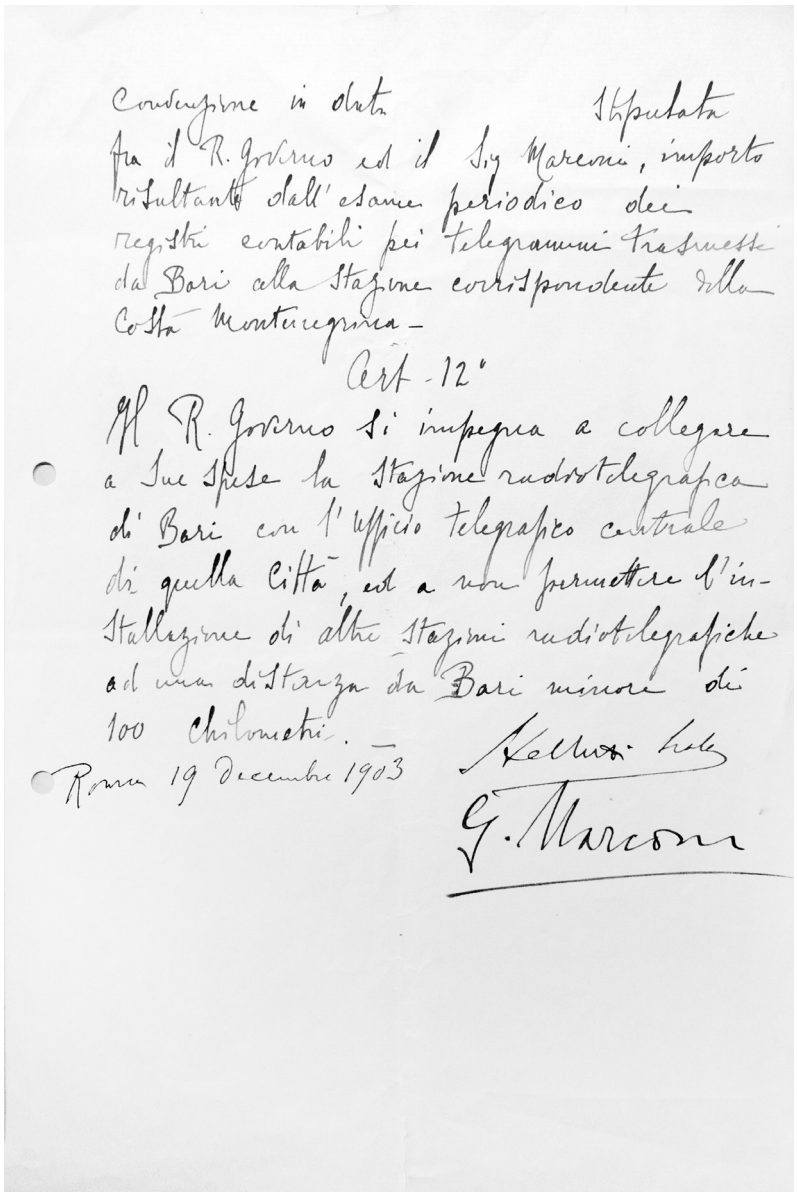
In base all'art° 5° della Convenzione in data 19 Maggio 1903 stipulata fra il R. Governo ed il Comm. Marconi, è accordata al detto Sig. Marconi la concessione dell'impianto e dell'esercizio di una stazione radiotelegrafica a Bari per corrispondere con altra analoga che a sua cura sarà impiantata nel Principato del Montenegro.

Art 2°

La stazione di Bari sarà costruita a spese ed a rischio del Comm. Marconi, al quale saranno devolute le tasse contemplate dall'art 5° sopracitato

Art 3°

La concessione è data per anni dieci con decorrenza dal giorno della entrata in esercizio della stazione, ed al termine della concessione stessa tutto l'impianto potrà passare, dietro sua richiesta, al



Convenzione in data Stipulata fra il R. Governo ed il Sig. Marconi, importo risultante dall'esame periodico dei registri contabili pei telegrammi trasmessi da Bari alla stazione corrispondente della Costa Montenegrina –

Art. 12°

Il R. Governo si impegna a collegare a sue spese la stazione radiotelegrafica di Bari con l'ufficio telegrafico centrale di quella Città, ed a non permettere l'installazione di altre stazioni radiotelegrafiche ad una distanza da Bari minore di 100 chilometri. –

Roma 19 Dicembre 1903

Stelluti Scala

G. Marconi

Figures 3a-b The first and last page of a handwritten agreement between Enrico Stelluti Scala, Minister of Post and Telegraphy, and Marconi, signed by both on 19 December 1903, for the construction and management of the Bari Radiotelegraphic Station, strategically important because it linked Italy with Antivari, in the Principality of Montenegro. Marconi had personal and commercial interests in relations with this Balkan state (Raboy 2016, 267). OBL MS Marconi 197, 19

> In 1909-1910 the Italian Government, due to pressure from the French and German Governments in favour of their national systems, requested that Guglielmo Marconi permit the Italian stations to communicate with French and German ships, even if equipped with systems different to Marconi's […]. This significant modification, requested to benefit foreign systems, was accepted by Marconi and confirmed in the additional Agreement on 6 February 1911. […] Mr. Marconi was willing to make such a concession permitting the Italian Government to ratify The Berlin Convention and thereby participate in the London Conference [in 1912]; he simply highlighted the damages that could be caused to him and his Companies as a result of such new concessions. (Ufficio Marconi 1915, 3; transl. by the author)

But the debate and tensions with the Italian government had in reality been going on for some time, dating back to the early 1900s and the radiotelegraphic conferences in Berlin. In the 1903 conference Carlo Grillo, solicited by the French delegation to negotiate with Marconi and modify the agreement in favour of international wireless communications, promised to concentrate all his efforts on achieving this goal (*Documents* 1903, 49-50).

In fact, the Italian government sought to modify the agreement, pointing out that a change of idea would be desirable also for Marconi himself, for three reasons. The majority of delegates in Berlin had requested it and therefore it was a widespread objective; in granting this modification to the Italian government Marconi would win the approval of the other governments; in allowing intercommunication the Marconi Company could easily demonstrate its technical superiority and would therefore acquire a "spontaneous general consensus" on using "the Marconi system only".[8]

Guglielmo Marconi himself replied by letter in January 1904. He refused to change the contracts with the Italian governments for at least four reasons. Firstly, allowing apparatus designed by different companies to intercommunicate was, in his view, technically impossible and, should it be possible, it would create legal and commercial difficulties. Secondly, in doing this Marconi would be endorsing the violation of his own copyright insofar as the other systems were deemed to be simple copies of Marconi's – this concept was again repeated in 1915, as we saw earlier. A third reason that prevented Marconi from accepting the request of the Italian government lay in the fact that there were agreements drawn up with other parties (for example, with the British company Lloyd's and the British Navy) which included the clause of non-intercommunication and Marconi could not give preference solely to Italy. Finally, again according to Marconi, not one Marconi Company client up to that moment had asked to modify the contract: this meant that the clause of non-intercommunication was in the favour of public interest.[9]

In 1905 Guglielmo Marconi unexpectedly proposed the termination of his contract to the Italian Ministry of Post and Telegraphs, due to the "unfavourable opinion expressed by a section of the Italian press". Obviously the revocation of the signed contracts meant that also "the Italian government, as well as the Marconi Company and himself, would be relieved from any obligations whatever under the said agreements".[10] The Ministry of Post declined the proposal, above all because it would have involved giving up the free use of Marconi's patents and

8 OBL MS Marconi 212,7, letter from the Ministry of Italian Marine to Guglielmo Marconi, 11 September 1903.

9 OBL MS Marconi 204,6, letter from Guglielmo Marconi to Ministry of Italian Marine, January 1904.

10 OBL MS Marconi 393,1, f. 216, meeting of the Board of Directors, 19 October 1905.

therefore having to relinquish Italy's favourable position at the time. In a 1906 letter the managing director of the Marconi Company, Cuthbert Hall, underlined that withdrawing from the contracts without consulting the shareholders was a risky move, which could put Marconi in person and Hall himself "in a very awkward position if the Government had closed with the offer". However, it turned out to be a calculated risk because, as Hall verified, "it [the Italian government] to close with the offer and therefore we did not, I suppose, give so much consideration to the matter as we should have done if there had been any chance of acceptance".[11] In other words, Marconi had proposed that the Italian government withdraw from the 1904 agreement, knowing that it was not in a position to accept at that moment in history. As we have already said, the Italian government was unable to modify these agreements until 1911, at which point the non-intercommunication policy was essentially abandoned by Marconi himself. But these same agreements strongly influenced the ways in which Italy could operate on the international stage, and, for example, Italy was unable to sign the final protocol of the Berlin Conferences, either in 1903 or 1906. During the preliminary conference, the Italian delegation agreed to submit the proposals contained in the final protocol to its government but declared to be unable to sign due to "agreements made with Mr. Marconi" (*Documents* 1903, 87).

These agreements contained at least two elements that tied Italy's hands in an international context. Marconi required the Italian government to keep secret any information relating to wireless telegraphy infrastructures and equipment (but the first article of the international convention compelled the sharing of this information in all other countries). Moreover, Italy could not give its permission for intercommunication without Marconi's authorisation because it was the only country at the international meeting contractually bound to him on this matter. Even if negotiations took place for a new agreement between 1903 and 1906, nothing had changed at the second Berlin Conference and the Italian delegate had to declare that

> The conditions of these contracts are contrary to the fundamental articles that we are discussing in this Convention. […] we cannot fulfil them before the expiry of our contracts or before the other party agrees to amend the existing contracts. […] This course of action may seem more justified if we consider that M. Marconi has made an exception in favour of his nation, reserving it free use of his invention. (*Documents* 1903, 96)

4 Conflicts of Interest

Italy was also tied to the Marconi Company due to a longtime feature of Italian politics which also emerged in the history of telecommunications: conflicts of interest.[12] Influential figures close to Marconi were at the same time part of Italian politics. The most striking case was probably that of Luigi Solari. In 1901 the Ministry of the Navy enrolled Solari to reestablish a friendly relationship with Guglielmo Marconi, after Marconi had moved

11 OBL MS Marconi 205, 6, letter of Hall to Marconi, 12 November 1906, 9.

12 See, for example, the conflicts of interest between politics and business during the nationalisations of the telephone networks in 1907 (Balbi 2011). In general, regarding Italian political-economic 'style' in telecommunications, see Balbi, Fari, Richeri 2014.

to Great Britain to found his company at the end of the 1900s. Solari succeeded remarkably well and immediately found himself in an intermediary position because he was both a Navy representative and a friend and collaborator of Marconi (Cavina 2009, 135). Solari's ambivalent role was also recognised by the management of the English Marconi Company which aimed to 'use him' to negotiate wireless communication with Italy. Solari was so valuable that, in February 1906, when Marconi was debating the imminent Berlin Conference with the Italian government, Hall found himself in doubt about or not to inform the Italian government about contracting Solari:

> I do not see that we can say that we have actually signed an agreement with Solari, because if the Government by any chance took exception to the arrangement we should be rather in a quandary. I think some communication ought to be sent, however, as otherwise of course it is quite open to the Department to say that, in the absence of any formal notification from you and us, they cannot recognize him as authorized to act for us.[13]

Sources indicate that Solari was paid by the Marconi Company from 1903 and officially hired by the company in 1905. This means that in 1903 he officially participated as one of the Italian delegates who worked for the Ministry of Post and, informally, as one of Marconi's representatives, or at the very least his role and his conflicts of interest were clearly evident. His conduct during the Berlin Conference in 1903 was equally clear and he was among those who refused any other solution apart from adopting a single system, obviously Marconi's. In the following years, Solari became Marconi's right-hand man in Italy, managing the Ufficio Marconi, which handled the affairs of the Marconi Company in Italy, and later even went on to become his official biographer **[fig. 4]**.

Figure 4 Official portrait of Luigi Solari (Bassano Ltd., 02/05/1924), copy without a background for company communication purposes (OBL MS Marconi 687). The original is located at the National Portrait Gallery in London

Another example of conflict of interests was the relationship between Hall, the managing director of the Marconi Company, and Colombo, the Italian delegate

13 MA, A.7.1/212, letter of Hall to Marconi, 10 February 1906.

at the Berlin Conference in 1906. The two constantly kept in touch during the conference and Hall sought to reassure Colombo that Italy would not remain isolated, "suggesting" that the Italian government complain to the British government regarding its "volte face".[14]

The link between the Marconi Company and the Italian delegates at the international conferences demonstrates at least two relevant aspects. Firstly, a closer relationship between the British company and the Italian government, and in particular the Naval Forces (while relations between Marconi and the Ministry of Post were still tense); secondly, the fact that Marconi was able to propose, and at times, dictate Italian policy at international level.

5 Marconi's Image

A third reason that helps to explain Marconi's influence over Italy involves Marconi himself, both as an inventor and as a symbol of Italian pride. Even though he had moved to London to patent wireless technology and capitalize on his patents, Guglielmo Marconi was born in Bologna, he felt Italian his entire life and, above all, continued to be a very popular figure throughout the country and also in the Italian imagination.[15]

The articles in popular Italian magazines and newspapers often glorified his 'magical' inventions as examples of 'Italian genius'.[16] He inspired writers and poets and many of them, such as his friend Gabriele d'Annunzio, composed pieces about him and his wireless telegraphy.[17] He was awarded many Italian honours, such as that of senator in 1914, president of the National Research Council (CNR) in 1927, and president of the Royal Academy of Italy in 1930. Marconi was also able to establish influential relationships with members of Italian high society, such as kings and queens, members of parliament, and heads of various ministries and banks. Lastly, and more generally, for a long time Marconi embodied Italy's image around the world, and for this reason, often held political positions in the first half of the twentieth century (Martelli 1995; Paoloni, Simili 1996).

However, the most relevant contribution perhaps of Marconi's Italian popularity to his British enterprise can be identified as the 'legend of the inventor' that surrounded him for his entire life (Fava, Ortoleva, Testaceni 1996). The aura of genius originally overlooked by his own country and being forced to emigrate to realise his ideas (*nemo propheta in patria;* no man is a prophet in his own land), ironically helped him to gain support and a certain freedom to act in Italy.

For example, during the parliamentary debate on the creation of the first Italian high-power wireless telegraphy station in 1903, many politicians expressed total confidence in Marconi. Even when his choices seemed debatable, such as with the non-intercommunication policy, the parliamentarians "ask […] not to impose any technical conditions on Marconi", convinced that he has "always found a way to overcome all difficulties, so he will find a way to win over anyone who opposes

14 OBL MS Marconi 205,1, letter of Hall to Marconi, 17 October 1906 and 30 November 1906.

15 Regarding the Italian life of Marconi, see Valotti 2015.

16 Numerous news cuttings are available on the website of the Fondazione Guglielmo Marconi http://www.fgm.it.

17 Many of these poems are preserved in OBL MS Marconi 40, 5.

this station".[18] As we are often told by all of the identical types of biography on genii, heroes and inventors, for Marconi too it was not easy to realise his ideas and he was opposed by various enemies. In particular, the main antagonistic roles in these accounts were played by the German and French private companies who copied his inventions from the start and subsequently aimed to enter the wireless telegraphy business. The Italian delegates at the international conferences highlighted this many times, maintaining that the inventor of wireless technology should have merited special consideration from the international community. In Italy, many commentators defended Marconi as a victim of economic and political attacks by Germany and its companies: we recall, for example, that the 1903 conference took into consideration "only the radiocommunications between ships and the coast, at a limited range, [and] completely ignored the issue of long-range stations" simply because at the time Marconi was still "without competition" in transatlantic radio telegraphy and "it probably didn't suit opponents of the single system to consider this argument" (Villarey 1903, 5).

Finally, according to many observers, Marconi was extremely generous to his home country, because he allowed the Italian government to use his equipment at no cost. This aspect of Marconi's image, namely the respect and particular consideration for his home country was precisely crafted by Marconi himself and by his biographer Luigi Solari.[19]

How could we not allow this champion of 'Italian genius', this victim of international competition, this generous son of Italy to use his country and his home government as a sort of defence lawyer, engaged to protect the interests of Marconi at an international level?

6 Conclusion. Centritalia

The influence of Marconi and the Marconi Company on Italian radiotelegraphic policy was long-standing. It remained significant not only during World War I and when Marconi lost the assignment of wireless telegraphy in 1923, reacting furiously against Mussolini's government, but also in the 1930s and 40s when he instead played a leading role in developing radio broadcasting in Italy and elsewhere.[20]

The first two international conferences on wireless communication analysed in this chapter allow us to comprehend something special and unique about the relationship between Marconi and his home country. On the one hand, the Italian delegates found themselves in an uncomfortable position: they had to fight against the majority of other countries and defend the policy of non-intercommunication desired by Marconi to honour the agreement signed between the Italian government and Marconi himself. On the other hand, however, perhaps for the first time in the history of telecommunications, Italy found itself at the centre of international politics and negotiations: the *diktats* of Marconi, in other words, turned Italy into an exemplary case study for international wireless policy.

18 Italian Parliamentary debates, 20 February 1903, 5704 and 5707.

19 See, for example, Solari 1940, in which Marconi's respect, benevolence and deference to Italy is fanatically recalled.

20 Regarding the role of the Marconi Company and Marconi on Italian radiotelegraphic, radiotelephonic and radio broadcasting policy, see Sangiovanni 2024.

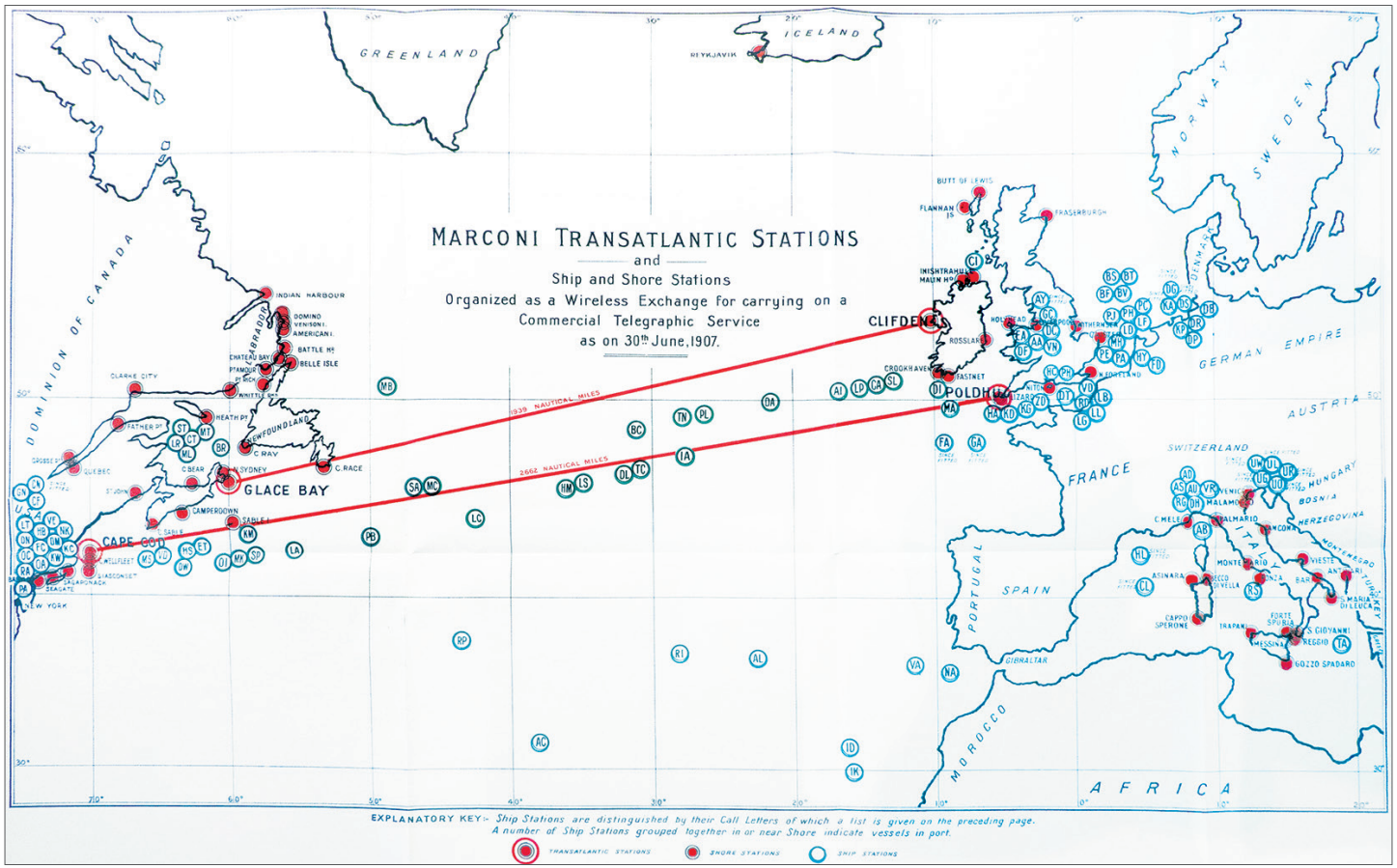


Figure 5 Photo of a 1907 map of the Marconi Company's transatlantic stations.
MWTC attachment, *Annual Report and Statements of Account. For the Period ending 30th September 1907*. OBL MS Marconi 401

At the same time, they unintentionally revealed, how crucial Italy was for the British Marconi company itself. By simply observing a map of the radiotelegraphic stations around the world, we understand how, in the first decade of the 1900s, Italy was one of the Marconi Company's most important clients **[fig. 5]**.[21] But Italy became something more to the British company on an international level. It was the country on which the Marconi management could count, even more so than England itself where the company had its headquarters. Italy was the country that helped the Marconi Company most, and defended it on the international scene. It was the last to sign the Berlin Conference protocol in 1911 when Marconi decided to modify his agreement with the Italian government. In 1906, when the Marconi Company realised that England would no longer defend its non-intercommunication policy, the company management considered moving its business, as Hall seems to imply in this letter to Marconi:

> I note that you are concentrating your attention almost exclusively upon Italian business, and the development of the Marconi system in Italy, particularly for Italian Government (Naval and Military) purposes. It is not unnatural that the principal extensions and development of the Marconi system should in future be primarily in relation to Italian Naval interests. These facts ought to receive wide publicity in the Press.[22]

In conclusion, Marconi's *diktats* to Italy could be reinterpreted as part of a broader strategy, aimed at making the country itself the gravitational centre of its business affairs, and more generally of its international image.

21 See OBL MS Marconi 581, 4 and the map in OBL MS Marconi 401 here reproduced.

22 OBL MS Marconi 205, 1, letter of Hall to Marconi, 22 November 1906, 3.

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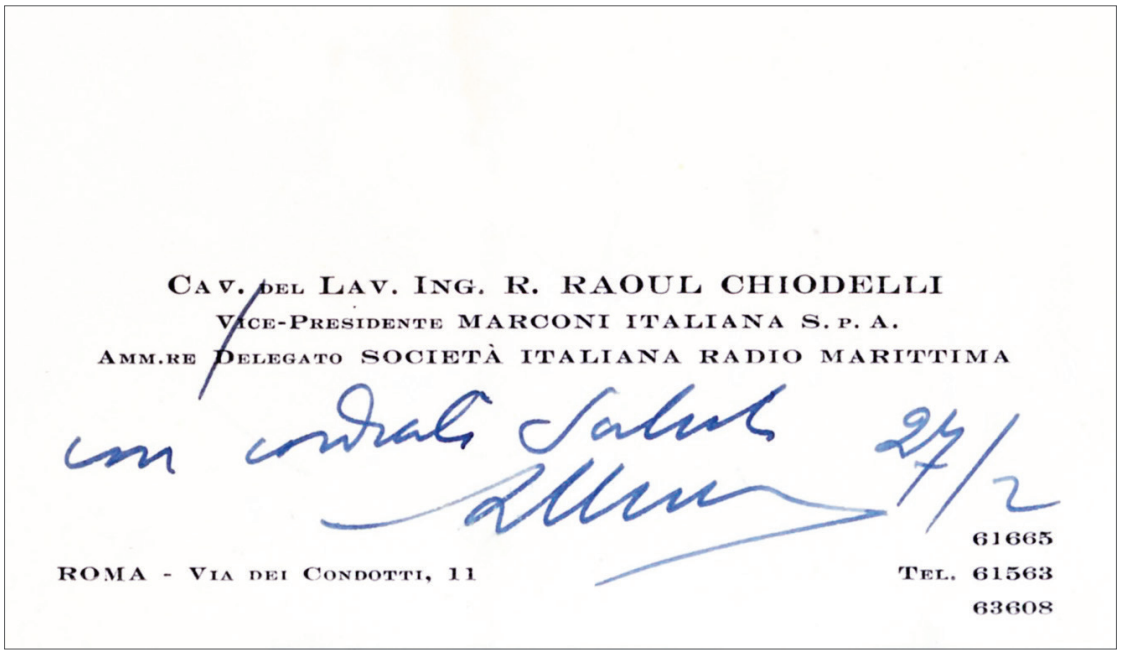


Business card of Rodolfo Raoul Chiodelli with handwritten notes. ASMUST, Archivio del Museo, Allestimento sezioni museali. Telecomunicazioni, b. 5 Cimeli marconiani e Sala Marconi, signed business card 27 February 1956

This document, preserved in the MUST historical archive, although seemingly marginal at first glance, should be interpreted within the context of the intense correspondence between Chiodelli and the founder Guido Ucelli regarding the acquisition of Marconian 'artefacts' from the Marconi companies. The historical archive, in fact, preserves the documentation related to the institutional history of the Museum and therefore also anything connected to the acquisitions and gallery installations during its 70 years of operation. Information and perspectives on Italian industrial history often emerge from this material, viewed from the particular perspective of its relationship with culture and education. The document is interesting because it reveals that Rodolfo Raoul Chiodelli (Rome, 1896-1982), one of the most important figures on the Italian radio scene in the period between the 1930s and 1960s – first as Director General of the URI – Unione radiofonica italiana (Italian Radiophonic Union) (1924) and later of the Ente italiano audizione radiofoniche (Italian Body for Radio Broadcasting) (1928-43) – undertook in the 1950s both the positions of Vice President of Marconi Italiana S.p.A. and Managing Director of the Società italiana radio marittima (SIRM) from 1954 to 1966. It should also be noted that the locations of both the Società italiana Marconi and SIRM were at the same address, in via Condotti 11 in Rome. This seemingly secondary detail reveals important aspects about the industrial history of the Marconi Company in Italy, a topic that has not been studied in detail. Although Chiodelli's relationship with Marconi began rather late (from 1929 on) and was certainly not as close as that with his official biographer Luigi Solari (Balbi, *infra*), his role was fundamental in the post-war period, to consolidating in Italy the activities of a commercial enterprise that had already been operating around the world for decades.

The Business Card of Raoul Chiodelli
Marconi Italiana: Industry and Public Memory (1921-60)

Giovanni Pietrangeli
Museo Nazionale Scienza e Tecnologia Leonardo da Vinci

One of the many 'legacies' of Guglielmo Marconi concerns the organisation of the business network which bears his name. In the following pages, we will focus on the Italian branch of the inventor's eponymous holding company, from strictly industrial business dealings to the management of the Marconi 'brand', carried out through relations with cultural and educational institutions, including what was then the Museo Nazionale della Scienza e della Tecnica di Milano (now the Museo Nazionale Scienza e Tecnologia). This relationship with the Museum is documented by the intense correspondence in the 1950s between the founder Guido Ucelli, and one of the most prominent figures in Italian radio during the transition from fascism to the early years of the Republic: Rodolfo Raoul Chiodelli (Monteleone 1995, 33).[1] Today this correspondence is stored in the MUST historical archive: therefore to rebuild the history of the objects collected by MUST – including those related to Marconi presented in this collection of essays – the archive should be the first port of call to carry out research.[2] Even documents that seem irrelevant or residual can provide us with important information, if evaluated correctly: this is the case with the business card pictured here.

What does this seemingly insignificant document tell us? First of all, it tells us about Chiodelli and his role in the Marconi companies. During the twenty years of fascism, Chiodelli was the Director General of the URI – Unione radiofonica italiana (Italian Radiophonic Union), later becoming managing director of the EIAR, and he had certainly developed ties

1 As he himself states in his volume, Monteleone is also the author of the entry dedicated to Chiodelli in https://www.treccani.it/enciclopedia/rodolfo-raoul-chiodelli_(Dizionario-Biografico)/.

2 See the contributions of Casonato, Guagnini and Spada, *infra*.

to Luigi Solari, Marconi's close collaborator and vice president of the same URI. From 1929 Chiodelli had also forged a relationship with Marconi, whom he met in London that same year.[3] After World War II he remained a very important public figure for Italian radio and held numerous managerial positions.

As stated on his business card, he was the managing director of Marconi Italiana S.p.A., supervising the reconstruction of systems damaged by the war, and he performed the same role at Società italiana radio marittima (SIRM). This too had been established within the Marconi business network, and was the only official provider of the Ministero delle comunicazioni italiano for the purchase and rental of mandatory equipment required for merchant ships weighing more than 1,500 tonnes.[4] In relation to the history of Marconi's business dealings, of particular interest is the role that these companies and prominent figures like Chiodelli played after Marconi's death, not only in carrying on the business activities, but also in managing the symbolic legacy linked to the inventor's name.

Now we come to the second set of reflections which – according to the author – are motivated by the business card displayed here: how was the galaxy of Marconi enterprises structured in Italy? Which companies were a part of it? How were they positioned within the post-war ecosystem of Italian industry?

In the following pages we will attempt to outline the historical contribution made by the Marconi businesses in Italy. The company documentation, preserved in the historical archive of MUST, the Archivio Centrale dello Stato (ACS) and the Bodleian Libraries in Oxford (OBL) will act as our guide. Writing a preliminary, partial draft about the history of the numerous 'Marconi' companies proved to be anything but easy, mainly because of the extreme fragmentary nature of the documentation, scattered in Italy and the United Kingdom, and because, as we will see at a later stage, the history of these enterprises is not linear, due to changes in business names, composition of shareholdings and the influence of politics on company strategies.

1 Marconian Enterprises in Italy (1921-60)

As clearly described by William J. Baker and Anna Guagnini in their studies, the research, commercial, and technical application activities soon took on converging trajectories in the biography of Guglielmo Marconi (Baker 2002; Guagnini 1995, 355-418; 2006, 175-212). Supported by his family's business know-how, Marconi founded the first of a network of enterprises in July 1897 which, operating in the international market, provided hardware and software for setting up wireless technologies to communication and navigation companies.

By 1913, approximately ten subsidiaries and affiliated companies had been established under the umbrella name of the Marconi Wireless Telegraph Co. (MWTC), with locations in the United Kingdom, United States, Canada, Argentina, France, Russia, Spain and Belgium.[5] The absence of a true Italian subsidiary, 16 years after the

3 https://www.treccani.it/enciclopedia/rodolfo-raoul-chiodelli_(Dizionario-Biografico)/.

4 ACS, Istituto per la Ricostruzione Industriale (IRI), Serie rossa, Pratiche societarie, Marconi italiana, b. R1261, report *Compagnia italiana Marconi spa-'Marconi' Società industriale per azioni*, 1949.

5 ACS, Presidenza del Consiglio dei ministri, Gabinetto, 1913, fasc. 6, *Promemoria circa le convenzioni tra il Governo italiano e il comm. Marconi*, June 1913.

founding of the first Wireless Telegraph Co, stands out.

'Ufficio Marconi' had already existed in Rome since 1904, just as the Officine Radiotelegrafiche Marconi had been opened in Genoa in 1912. However, it was not until June 1921 that an Italian company was set up within the Marconi network.[6] Defined 'authentically Italian' due to its investment capital, business address and staff, its establishment was most likely due to the opening up of the state radiocommunications systems to private company tenders, rather than to a renewed patriotic enthusiasm on the part of Marconi. He had nevertheless been the supplier of the Italian Navy since 1902, and had signed a well-known convention in 1904 allowing the Italian government to use his devices (Paoloni, Simili 1996, 83, 113; Balbi, *infra*).

Despite its late arrival, the Società italiana Marconi immediately took on a significant role in the history of Italian communications, including those for civil use. It participated as a majority shareholder in the establishment of the URI, which became EIAR in 1927 (Paoloni, Simili 1996, 114).

The 1930s, and especially the years 1934-35, were crucial for the fascist regime, with two events standing out in particular. The first was the plebiscite on 25 March 1934, in which Italian voters – only male – were asked to vote yes or no to a closed list of names for the Chamber of Deputies, and the second was the invasion of Ethiopia with the resulting international sanctions. These incidents on the one hand consolidated Mussolini's power on an internal level and on the other caused Italian international relations to become more tense (Del Boca 1979; Labanca 2005).[7] During the same years Marconi, already a senator and president of the CNR, saw the deterioration of his relationship with the United Kingdom, and above all of his business relations across the English Channel, with subsequent effects on both political and economic matters (Raboy 2016, 614-16).

Within Italy, instead, thanks to support from public suppliers, business seemed to proceed as normal. Sestri, the Genoa plant, employed more than a thousand people until 1942, with an 'absolutely dominant' production of equipment for the Italian Navy, including radio transmitters and receivers, telephones and telegraphs, radiogoniometers, ecometers, nautical instruments, and transmitter and receiver valves.[8] In 1943, in the middle of World War II – although with a certain delay due to the beginning of hostilities – San Giorgio, a large mechanical and metallurgical engineering company in Genoa, acquired their assets, which had been seriously damaged in bombings the previous year, along with the Italian business of the MWTC, at a total value of 24 million lire.[9] This operation therefore led to the establishment of a Compagnia italiana Marconi (CIM), with plants relocated for post-war reasons to Pistoia and Cambiano in the province of Turin. At the end of the war the plants returned to Sestri, where San Giorgio also had its headquarters and from there, despite having a halved workforce,

6 OBL MS Marconi 1707, *Le Officine Radiotelegrafiche Marconi di Genova. Cenno storico e descrittivo*, 1922.

7 https://patrimonio.archivioluce.com/luce-web/detail/IL5000011984/2/il-plebiscito-anno-xii-nella-giornata-elettorale-tutti-i-cittadini-italiani-hanno-compiuto-loro-dovere.html&jsonVal=. Significant propaganda document on the 1934 plebiscite, won with almost 100% of yes votes.

8 ACS, IRI, Serie rossa, Pratiche societarie, Marconi italiana, b. R1261, report *Compagnia italiana Marconi spa-'Marconi' Società industriale per azioni*, 1949.

9 ACS, IRI, Serie rossa, Pratiche societarie, Marconi italiana, b. R1261, report *Compagnia italiana Marconi spa-'Marconi' Società industriale per azioni*, 1949.

recommenced business activities in some fields, although it failed in returning to pre-war capacity.[10]

A lot changed in the years 1947-48, but in reality, very little or nothing changed regarding the structure and operation of the Società italiana Marconi, at least in the short term.

On 28 January 1948, at the Rome CIM offices in via Condotti 11 (the same address as that of the Italian office of the MWTC), the Marconi società industriale (MSI) was established, with the participation of both the former CIM, represented by Aldo Terenziani, and the Società italiana Marconi represented by Giulio Marconi **[fig. 1]**, son of Guglielmo, although with a 4% stake that was mostly symbolic.[11] The presence of Giulio Marconi, along with the location at which the founding deed was drawn up and where the MSI would later have its headquarters, represent two important elements of continuity – symbolic rather than industrial – in the business activities of Guglielmo Marconi and those which were set up after his death in 1937.

The new company, still partially owned by San Giorgio through CIM shares, therefore became part of the founding core of the newly formed Finmeccanica, the public conglomerate that would manage the mechanical enterprises within the IRI framework for the entire post World War II period.

The MWTC finally joined CIM and the Società italiana Marconi, entering with a share capital of 48%, on an equal standing to San Giorgio, due to reparative agreements.[12]

The first years of business after the restructuring did not seem particularly encouraging, rather they highlighted important contradictions within the general organisation of the Finmeccanica universe. Firstly, the contracts that Marconi had brought to San Giorgio were deemed to be "negligible".[13] In the meantime Microlambda had been founded, a trailblazing company in Italian radar technology (Bricco 2023, 109-17), thus Finmeccanica found itself in the uncomfortable position of developing an industrial strategy to avoid redundancies and inefficiencies in the naval communications sector. Moreover, CIM finances were not exactly flourishing, and between losses and other pre-existing debts, San Giorgio found itself in the position of having to manage about 280 million lire in losses, just as the MSI chapter began.[14]

However, prospects seemed more promising with the founding of the MSI: first of all, production had returned to focus on the original Marconi enterprises, namely components and instruments for naval communication. Due to the war, and its entry into the radio gramophone market, CIM, had in fact lost market share and found itself in a highly competitive sector. Although it was a difficult legacy to manage – more than 50 million lire in losses in the first year of business and plants operating at 85% of their potential – the prerequisites for a recovery seemed to be in place.[15] In 1956, Pasquale Saraceno devoted

10 ACS, IRI, Serie rossa, Pratiche societarie, Marconi italiana, b. R1261, report *Compagnia italiana Marconi spa-'Marconi' Società industriale per azioni*, 1949.

11 ACS, IRI, Serie rossa, Pratiche societarie, Marconi italiana, b. R1261, Founding deed and articles of association, 28 January 1948.

12 ACS, IRI, Serie rossa, Pratiche societarie, Marconi italiana, b. R1261, Founding deed and articles of association, 28 January 1948.

13 ACS, IRI, Serie nera, Affari generali e organi deliberanti, Comitato di presidenza, meeting of 16 May 1951.

14 ACS, IRI, Serie rossa, Pratiche societarie, Marconi italiana, b. R1261, report *Compagnia italiana Marconi spa-'Marconi' Società industriale per azioni*, 1949.

15 ACS, IRI, Serie rossa, Pratiche societarie, Marconi italiana, b. R1261, report *Compagnia italiana Marconi spa-'Marconi' Società industriale per azioni*, 1949.

Figure 1 *The Marquis Giulio Marconi (son of Senator Marquis Guglielmo Marconi) speaking with Captain Willett, Director General of Marconi Company at the opening ceremony*.
Photo taken in London in 1947 for the jubilee of MWTC, OBL MS Marconi d73

Figure 2 Giulio Marconi, Minister of Defense Randolfo Pacciardi and Raoul Rodolfo Chiodelli at the inauguration of the valve manufacturing plant in L'Aquila. 1952. OBL MSS photograph c322-3

Figures 3-4 Operators at work at the valve manufacturing plant in L'Aquila, OBL MSS photograph c258-9

some sections of his study on the IRI – its origins, order and business from its setup to the year of writing – to MSI. Within the broader framework of reconversion – to some extent problematic as highlighted by Saraceno – the Marconi company represented a somewhat strategic investment. Not only because of the type of production required for radio transmitter instrumentation, thermionic valves and electronic devices, but also because the Marconi company was responsible for the construction of the valve manufacturing plant in L'Aquila: one of the few areas of post-war industrial development in Southern Italy outside of Naples (Saraceno 1956, 92) **[figs 2-4]**.

Nevertheless, this positive evaluation was not shared in the United Kingdom, where, in December 1956, the MWTC was not only having to account for the financial losses of the Italian subsidiary, but also for some questionable managerial decisions that were conspiring to make the relationship between the parent company and MSI unsustainable.[16] Although 1957 and 1958 seemed to generate positive results, in March 1959, a report originating in Italy and addressed to the English Electric Company (EE) – which had controlled the MWTC since 1945 – signalled the ongoing difficulties being experienced by the Marconi italiana branch in efficiently navigating the Italian public electronic system.[17]

In March 1958 the chief auditor for the MWTC had already highlighted redundancies at the Ligurian plant and the need to reduce investments and liquidate reserves of precious metals such as silver, tungsten and copper. In L'Aquila, on the contrary, a new production line was being completed thanks to a loan granted by the Istituto Mobiliare Italiano and forecasts were clearly more positive.[18]

In May of the same year, it was Finmeccanica itself that proposed a thorough restructuring of the Marconi interests in Italy, starting with the sale of the plant in L'Aquila, which was therefore transferred to the company ATES – set up ad hoc and still a part of Finmeccanica.[19] The plant in Genoa, which with its array of inefficiencies and debt, remained the only industrial site in Italy available to the MWTC (and therefore to the EE), found itself the subject of an external audit carried out from 1959 to 1960 which drew attention to the serious financial situation towards which the company was headed.[20] The history of the Marconi italiana – simplifying with this designation the complex web of businesses that carried the inventor's name – carried on for another two decades. Regarding the scope of this article, the description of company affairs will stop in 1960.

The last documents preserved in Oxford are the transfer deeds for the assets of the Italian Marconi company to yet another 'Marconian' company, the Marconi italiana industrie spa, established in May 1980, but whose link with the business network originating from the MWTC was little more than nominal.[21]

On 4 July 1980, at the end of a long and difficult business period, Douglas Graham Smee, the director of the

16 OBL The Marconi Archives, MS Marconi 609, Italian companies 1956-65, MWT report on the progress of MSI, 10 December 1956.

17 OBL The Marconi Archives, MS Marconi 609, Italian companies 1956-65, letter to John Woods from EE, 16 March 1959.

18 OBL The Marconi Archives, MS Marconi 609, Italian companies 1956-65, report for Neil Sutherland, 4 March 1958.

19 OBL The Marconi Archives, MS Marconi 609, Italian companies 1956-65, letter from Finmeccanica (illegible signature) to John Woods of the EE, 12 May 1959; property valuation report on the plant in L'Aquila, 24 July 1959.

20 OBL The Marconi Archives, MS Marconi 610, Italian companies 1960-80, report on Marconi italiana, undated (1970).

21 OBL The Marconi Archives, MS Marconi 610, Italian companies 1960-80, founding deed of Marconi italiana industrie spa, registry 14285, 27 May 1980.

Milan branch of Marconi Italiana, wrote a note entitled Marconi Italiana reconstruction:

> For better, for worse, the deed is now done. The transfer agreement is as copy attached hereto, signed by myself as transferring the assets to Piccini [managing director of Marconi italiana industrie spa] and by Piccini paying for them with the new company's shares, the signature duly notarised […]. Thus the only notification to be made to customers, suppliers, etc. is to draw their attention to the fact that the registered number and registered address of Marconi Italiana have been changed to… There will be no other comment, publicity, etc.[22]

2 The Marconi Brand and Its Public Memory

In an article dated 2017, Greg Elmer presented an interesting and original interpretation of the Marconi enterprises as catalysts for financial resources, in their clear ability to represent themselves as innovative companies and highlight the effectiveness of their own products (Elmer 2017).

This is probably even more accurate when discussing the Italian organisations within the Marconi universe.

These companies suffered the consequences of the transformation of the competitive landscape, the persistence of structural flaws, wartime damage and some complex changes in company set-up.

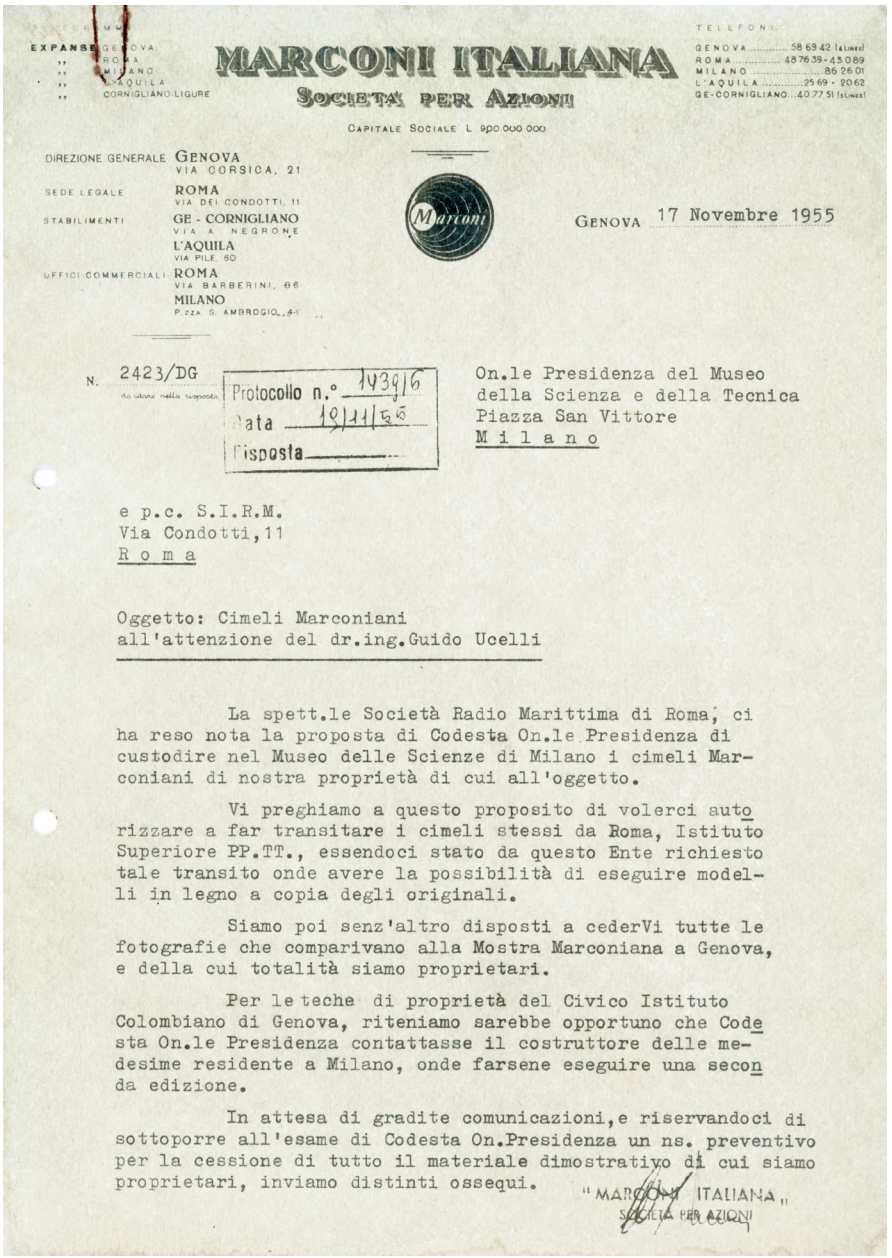
Within this scenario, during the 1950s the relationship between the Marconi companies and the then Museo Nazionale della Scienza e della Tecnica began to take shape, in particular between the Museum founder Guido Ucelli and Rodolfo Raoul Chiodelli.

In the mid-1950s the two engaged in intense correspondence, in relation to the destination of the so-called 'Marconi relics': objects produced by the MWT and by other businesses largely for promotional and demonstrative purposes, as is confirmed by both technical elements and documentation. The issue of the artefacts, which is rather more complex than described in this brief summary **[fig. 5]**, and explored in more depth in the other essays in this catalogue, introduces us to this archipelago of companies, all – or nearly all – of which had a business brand that echoed the name of Marconi, evocative enough to almost turn it into an asset, an intangible heritage which carried a tangible value in the network of relations interwoven between the worlds of industry, culture and technical-scientific education.

In conclusion, there are perhaps more questions than answers when trying to outline the history of the Marconi business activities in Italy, and even more so when attempting to consider it in relation to the dissemination of Guglielmo Marconi's public memory in Italy.

The first question is: which companies can effectively be defined as Marconi organisations in post-war Italy? It has been shown that Marconi only 'embarked' on his Italian business ventures in the 1920s, within a context of institutional and economic conditions which had become more favourable at the time than during the initial stages of his business network. However, the war, the restructuring of Italian capitalism after fascism, and the repositioning of Italy on the global market had redefined these conditions. In the meantime, Marconi had passed away, and his industrial legacy had been passed down to his

22 OBL The Marconi Archives, MS Marconi 610, Italian companies 1960-80, letter from Douglas Graham Smee to Robert Telford, president of the MWT, 4 July 1980. It should be noted that within Leonardo spa, the successor to Finmeccanica, there are still activities under the Marconi name.



EXPANSE GENOVA
ROMA
MILANO
L'AQUILA
CORNIGLIANO LIGURE

MARCONI ITALIANA

SOCIETÀ PER AZIONI

CAPITALE SOCIALE L. 900.000.000

TELEFONI
GENOVA ..... 58 69 42 (4 linee)
ROMA ..... 487639 - 43089
MILANO 86 26 01
L'AQUILA ..... 2569 - 2062
GE-CORNIGLIANO ... 40 77 51 (5 linee)

DIREZIONE GENERALE GENOVA
VIA CORSICA, 21
SEDE LEGALE ROMA
VIA DEI CONDOTTI, 11
STABILIMENTI GE - CORNIGLIANO
VIA A. NEGRONE
L'AQUILA
VIA PILE, 60
UFFICI COMMERCIALI ROMA
VIA BARBERINI, 68
MILANO
P.zza S. AMBROGIO, 4-1

GENOVA 17 Novembre 1955

N. 2423/DG
da citare nella risposta

Protocollo n.° 143916
Data 18/11/55
Risposta

On.le Presidenza del Museo
della Scienza e della Tecnica
Piazza San Vittore
M i l a n o

e p.c. S.I.R.M.
Via Condotti, 11
R o m a

Oggetto: Cimeli Marconiani
all'attenzione del dr.ing.Guido Ucelli

La spett.le Società Radio Marittima di Roma, ci ha reso nota la proposta di Codesta On.le Presidenza di custodire nel Museo delle Scienze di Milano i cimeli Marconiani di nostra proprietà di cui all'oggetto.

Vi preghiamo a questo proposito di volerci autorizzare a far transitare i cimeli stessi da Roma, Istituto Superiore PP.TT., essendoci stato da questo Ente richiesto tale transito onde avere la possibilità di eseguire modelli in legno a copia degli originali.

Siamo poi senz'altro disposti a cederVi tutte le fotografie che comparivano alla Mostra Marconiana a Genova, e della cui totalità siamo proprietari.

Per le teche di proprietà del Civico Istituto Colombiano di Genova, riteniamo sarebbe opportuno che Codesta On.le Presidenza contattasse il costruttore delle medesime residente a Milano, onde farsene eseguire una seconda edizione.

In attesa di gradite comunicazioni, e riservandoci di sottoporre all'esame di Codesta On.Presidenza un ns. preventivo per la cessione di tutto il materiale dimostrativo di cui siamo proprietari, inviamo distinti ossequi.

"MARCONI ITALIANA"
SOCIETÀ PER AZIONI

Figure 5
Letter from Marconi Italiana S.p.A. regarding the storage of Marconi relics at the Museo Nazionale della Scienza e della Tecnica di Milano and supplies of other materials. 17 November 1955. ASMUST, Archivio del Museo, Allestimento sezioni museali, Telecomunicazioni, b. 5, Cimeli marconiani e Sala Marconi

son Giulio and some other trusted individuals, who apparently had marginal roles compared to the main players in the group, including the MWTC which, as we have seen, held a distorted view of its business activities in Italy. It can perhaps be claimed that by the 1940s and 1950s the Marconi brand had become more of a label, whose credibility was based on the name itself rather than on the technological and industrial results, and that its use was strictly tied to the fame of the inventor, which became a cult of sorts in Italy.

In relation to this cult, another question arises: once the strictly industrial enterprises had been reorganised in the period between 1955 and 1956, to what extent did Chiodelli's management of the public use of Marconi's name and the care invested in the exhibition of the artefacts fulfil the exclusively promotional needs of the brand, as happened in the early stages of the MWTC, according to the analysis by Elmer. The similar types of artefact would seem to confirm this theory. Some of them were in fact produced for promotional and demonstrative activities and were exhibited with particular diligence by the industrial organisation, as in Milan and Genoa during the Colombus celebrations in 1955 **[fig. 4]**.[23]

Moreover, other questions emerge regarding Chiodelli's role: which needs was he addressing in his commitment to overseeing the fate of the Marconi relics, dealing with the Museum-related requests from institutions all over the country? Was he playing his role of trusted associate – yet his relationship with Guglielmo Marconi was a later development and certainly not comparable to that of Luigi Solari or George Kemp – or was it rather the role of the director of two companies within the Marconi universe struggling with its brand crises, which shortly afterwards would have its industrial assets reappraised, with the conversion of the Aquila plant to Aquila Tubi Elettronici e Semiconduttori (ATES)?

A figure such as Chiodelli, with expertise in the fields of commerce, politics, and culture – capable of simultaneously holding important positions in different companies, as indicated by the job titles on his business card – could well understand the value of Guido Ucelli's proposal to include Marconi and the Marconi company in the exhibitions at the Museo Nazionale della Scienza e della Tecnica. If the CNR was inevitably the custodian of the most precious 'relics' (Casonato, Spada, *infra*), the newly established museum was planning to become a 'pantheon' of science that was more accessible to the public, offering the chance to consolidate a strategic asset in a large, industrial city like Milan, as much intangible as precious: the memory surrounding the name of the inventor.

Beginning with the figure of Chiodelli, these pages have endeavoured to give a clear outline – up to now it has been somewhat vague – of the industrial enterprises that bore Marconi's name in Italy, within the framework of a comprehensive reflection on his scientific and entrepreneurial heritage 150 years after his birth (and it should be remembered also 100 years after the first broadcast of the URI). This is little more than an overview, to which it would be useful to return in more detail.

23 Casonato, Spada, *infra*. ASMUST, Archivio del Museo, Allestimento sezioni museali. Telecomunicazioni, b. 5 Cimeli marconiani e Sala Marconi, List of the material for the Sala Marconi received from Roma (07/04/1956), typescript of Franco Soresini, s.d. Interesting annotations by Soresini on the status of the replicas and the 'originals', which are however often identified as copies.

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Vincenzo Jerace ,
Bust of Guglielmo Marconi. 1940.
Plaster cast executed by Cesare Gariboldi in 1956
Inv. IGB 2135

The bust is a plaster cast commissioned in 1956 for the exhibition held in the Sala Marconi at the Museo Nazionale Scienza e Tecnologia Leonardo da Vinci. It was created by the Milanese plaster cast artist Cesare Gariboldi, based on the original, which is owned by the CNR (National Research Council) and modelled by the Calabrian sculptor Vincenzo Jerace. At the current stage of research, it is not known how the original work was commissioned. It is interesting that the request for such a commemorative bust was made to an artist at the end of his career, at almost eighty years of age. However, on the other hand, Jerace in his later years had dedicated himself to portraits of Roman high society, using a dynamic style of sculpting still linked to his roots in Verismo and Art Nouveau. The same applies to the portrait of Marconi, depicted in the dress uniform of the Accademia d'Italia, of which he was president, rising from a rough block of stone. Textured corrugations full of light and shade contribute to create a decidedly more intimate tone, in contrast to the works of artists linked to regime commissions, such as Arturo Dazzi, who by means of their apologetic style contributed to constructing the myth of Marconi on the national and international scenes. Over time, in fact, public commissions in the artistic domain have marked important milestones in the foundation of a rhetorical and ritualistic discourse surrounding the figure of Guglielmo Marconi.

The Commemorative Bust by Vincenzo Jerace
The Representation of Marconi *Post Mortem* (1937-59)

Claudio Giorgione
Museo Nazionale Scienza e Tecnologia Leonardo da Vinci

Shortly after the opening of the Sala Marconi at the Museum on 10 October 1956, the exhibition dedicated to the artefacts from the ship *Elettra* was documented by a curious photomontage that includes, in the centre, the plaster cast bust of Guglielmo Marconi **[fig.1]**. Commissioned by the Museum to a trusted plaster cast artist, Cesare Gariboldi,[1] the work documents how the iconographic legacy developed after Marconi's death leading to the commission of numerous works of art.

A starting point for retracing some important examples in this regard is the version of the same bust also in plaster at the Guglielmo Marconi Library of the CNR, created by the Calabrian sculptor Vincenzo Jerace at the end of a long career that had seen him a leader in sculpture ranging from Verismo to Art Deco.[2]

It was precisely the CNR, of which Marconi was president from 1928 until his death on 20 July 1937, that was an early promoter of the cult of Marconi, within a rhetoric that

1 Cesare Gariboldi (Milan, 1881-1971), plaster cast artist, worked at the Gipsoteca Vallardi, which had previously acquired the Carlo Campi Museum. In 1927, on the closure of the Vallardi, he and his partner Cesare Bertolazzi acquired a large portion of the materials and went on to work independently. For many decades he was the official plaster cast specialist at the Accademia di Belle Arti di Brera, where he had his own workshop. His work was later carried on by the mould casters Fumagalli and Dossi in 1974. In Milan he worked for the Musei Civici (Cast of the Pietà Rondanini) and for the Museo Nazionale della Scienza e della Tecnica (among his casts were busts of Alessandro Volta and Guglielmo Marconi, a bas-relief by Giovanni Balduccio, and most likely the Nike of Samotracia). See Spalla Gandola 1990; Mori, Piraina, Salsi 2022, 21-7.

2 Vincenzo Jerace (Polistena, 1862-Rome, 1947), trained at the Istituto di Belle Arti in Naples, beginning in the tradition of Napolitan Verismo, then subsequently embracing Art Nouveau. He later dedicated himself to the sculpture of monuments. See Valente 2019.

Figure 1 Sala Marconi: at the centre, the bust of Guglielmo Marconi (photomontage). 1956. Milano, Archivio Museo Nazionale Scienza e Tecnologia Leonardo da Vinci, AS 530. Foto Sella

Figure 2
Guarino Roscioli, *Busto di Guglielmo Marconi*. 1932-37. Consiglio Nazionale delle Ricerche. © Author

had already been established in the previous years. The *Documentario dei Primati Italiani*, created for the 1933 Chicago World’s Fair, already presented Marconi relics as a landmark in the glorious destiny of Italian genius,[3] while the successful propaganda book by Francesco Savorgnan, *Da Leonardo a Marconi*, saw Marconi, long before his death, as the contemporary alter ego of the Da Vinci genius, creating a short circuit at the root of the creation of the myth portraying Leonardo as the forerunner of modernity. [4]

Therefore it was not surprising that, when Mussolini officially opened the new CNR headquarters on

3 In relation to the *Century of Progress* Chicago World’s Fair, the CNR and the *Documentario dei Primati Italiani*, see Giorgione 2019a and Paoloni, Reali, Ronzon 2018 and the relevant bibliography.

4 Regarding the creation of Leonardo’s myth, and also its intertwining with the Marconian myth – see Beretta, Canadelli, Giorgione 2019. One of Leonardo da Vinci’s ‘prophecies’, much used by fascist propaganda and almost foreshadowing the invention of radio, was: “Men from very distant lands will speak to one another and answer” (Codice Atlantico, f. 1033*v*).

Figure 3 Antonio Achilli, *Da Palazzo Venezia, attraverso la radio, il Duce parla al popolo italiano*. 1937. Roma, Consiglio Nazionale delle Ricerche (destroyed fresco). In *Il Consiglio Nazionale delle Ricerche nella sua Nuova Sede* 2014

20 November 1937, only four months after Marconi’s death, a marble portrait of him **[fig. 2]** was already triumphantly displayed in the board room (*Il Consiglio Nazionale delle Ricerche nella sua nuova sede* 2014, 47-9).[5] It was sculpted by Guarino Roscioli,[6] who was also commissioned to realise the portraits of other eminent men such as Colombo, Leonardo, Galileo, Spallanzani, Galvani, Volta and Avogadro. Marconi, portrayed with bare shoulders like an epic hero, had already earned his place among the ranks of the great Italians, according to a sequence which is reiterated by the iconographic theme in the Salone del Gran Consiglio (today Sala Marconi). The theme was conceived by Edoardo Lombardi in 1936 and was inspired by the frescoes of Antonio Achilli,[7] drawing on the solid compositions of the great Renaissance fresco cycles, featuring statuary and monumental figures:

> On the wall upon which Science and Technology are depicted serving the country, the immense structure of Palazzo Venezia stands to the right, from where Man

5 There were two bronze busts displayed in the Salone del Consiglio, one of Mussolini himself and the other of King Vittorio Emanuele III, created by Domenico Ponzi (1891-1973). Regarding his role, see Iezzi, Sgarbi 2019.

6 Guarino Roscioli (Montottone, 1895-Rome, 1978) trained in Rome and worked in the Vatican on numerous public commissions in the period between the two world wars. Another of his busts of Marconi is exhibited in a hall dedicated to him at the Telecommunications Museum in Rome. Roscioli was already working on a portrait of Marconi in 1932, at least according to the correspondence between Umberto Marconi (Di Marco), special secretary to Guglielmo Marconi from 1930 to 1937, and George H. Clark, Radio Corporation of America (RCA): see Archivio Accademia Nazionale dei Lincei, Archivio Guglielmo Marconi, b. 2 fasc. 82 – Clark George H.

7 Antonio Achilli (Rome, 1903-1993), painter and mosaic artist, specialized in large wall decoration.

> guides the entire Nation, speaking to the disciplined and united people, who are industrious and fertile. His voice is not only heard by those crowding the square, but at the same time reaches the cities, the countryside, the docks and the construction sites, the men working with shovels and the men reading books, across the mountains and the sea, in war and in peace. This miracle is due to Technology, a new Technology which germinated from the brilliant insight of Guglielmo Marconi, supported by complex and challenging Science into which Mathematics and Physics are intricately interwoven. From this union sprang the awe-inspiring medium of radio broadcasting. The building of the National Research Council is depicted on the left, not an archive of outdated papers, but the driving life force of the Nation. (G.B. 1937)

The final scene of the cycle **[fig. 3]** explicitly referred to the invention of radio as a political instrument of the fascist regime, with Mussolini portrayed in Piazza Venezia on the occasion of the call to arms for the Ethiopian War on 2 October 1935.[8] In 1947, with the intention of eliminating references to the fascist regime, the scene was replaced with a new composition created by Antonio Achilli dedicated to the scientists of the 1800s, with four young maidens, as an allegory for the four elements, surrounded by Galileo Ferraris, Antonio Pacinotti, Augusto Righi and Guglielmo Marconi **[fig. 4]**.

The myth of Marconi, shaped by many of the episodes that would become recurrent themes in the narrative of his life (the rifle shot, the first patent, the first S.O.S.), had already become so widespread that an idealized biography was published as early as April 1938, authored by the historian and pedagogue Pietro Caccialupi, with the indicative title *Il dominatore dell'infinito* (Master of the Infinite). At the end of the book the author remembers of Marconi that

> He has passed into immortality, alive and present in the daily lives of the men united in gratitude towards this generous son of our earth, unsurpassed and unsurpassable giver of joy, master of space, time and even death. (Caccialupi 1938, 211)[9]

The political, literary and artistic celebration of Marconi continued at the same pace, and the same enthusiasm expressed in Caccialupi's words can be found in the works of art produced the following year. Beyond national borders, the most important monument to celebrate Marconi after his death was created on the occasion of the New York World's Fair, *The World of Tomorrow* in 1939.[10] On the brink of war and following the 1938 racial laws and its further alignment with Nazi Germany, Italy appeared with a show of force in an effort to regain international standing, by designing a sumptuous pavilion in clear architectural competition with the other totalitarian government present at the Fair, the Soviet Union. The Italian Pavilion **[fig. 5]** was described in this way, just a few weeks after its unveiling:

8 It was celebrated thus: "The allegory of Science and Technology at the service of Political Unity. From Palazzo Venezia, over the radio, the Duce speaks to the Italian people" (*Il Consiglio Nazionale delle Ricerche nella sua nuova sede* 2014, 66).

9 Caccialupi's book must have enjoyed great success, to such an extent that it was reprinted the following year. As well as having written educational textbooks for schools, Caccialupi had already penned a "Fior da fiore", a glowing critique, of Manzoni's *I Promessi Sposi* and other biographies of Italian heroes, such as Guglielmo Oberdan and Giosuè Carducci. Another biography, less rhetorical in tone, was published by Giuseppe Pession in 1941 in UTET's series *I grandi italiani*.

10 Regarding the Fair and his link to fascism, see Fortuna 2019. For a detailed description of the Italian Pavilion see *Italy at the New York World's Fair* 1939.

Figure 4 Antonio Achilli, *Allegoria dei Quattro Elementi tra Galileo Ferraris, Antonio Pacinotti, Augusto Righi e Guglielmo Marconi* (detail of the right side). 1947. Roma, Consiglio Nazionale delle Ricerche. © Author

> The national pavilion, approximately 40 metres wide and 150 metres long, was conceived according to a new and majestic, modernistic vision, without however excluding Latin tradition. A magnificent vestibule adorned with polychrome marble motifs provides entry to the main floor of the building, formed by a succession of vast spaces within which the majority of the exhibitions will be installed, ranging from industry to fine arts. […] A large symbolic statue in honour of Guglielmo Marconi, the work of the academician Dazzi, will be erected in front of the pavilion façade.[11]

According to the design of the architect Michele Busiri Vici,[12] the architecture re-envisioned an ancient temple from a modern perspective, showcasing two wings of porticos and an extremely high tower, from which rose a sculpture of the *Goddess Roma* **[fig. 6]**. The entrance was decorated with a double sculpture created by the Carrara sculptor Arturo Dazzi (1881-1966), who had already received numerous official commissions from the fascist government in that very period.[13] The work, entitled *La Radio col cuore in mano* (Radio with Heart in Hand), depicted a slender young woman holding a heart in her right hand, symbolizing the benefits that the invention of radio had bestowed on society. Worked from a single block of marble from the Apuane Alps, it was 5 metres tall.[14] At the base of the sculpture was a bas-relief portrait of Marconi, in which the inventor's face with its hieratic, almost post-Byzantine fixed expression and large, protruding eyes established an aesthetic standard that would endure over time **[fig. 7]**; the portrait seemed to emerge from the mirror of water formed by the waterfall alluding to the fascist *mare nostrum*. This is how it was described by Michele Biancale in his enthusiastic review in *L'illustrazione italiana,* after having praised Dazzi's ability to express an abstract concept such as radio using the female form:

> On the plinth of the statue, Dazzi sculpted the head of Marconi, four times its actual size, in bas-relief. It is natural that the artist now spiritually dwells within the orbit of Marconi's genius, especially considering that he was preparing to erect, for the E. 42 Exhibition, a

11 "La partecipazione italiana all'Esposizione di Nuova York". *Corriere della Sera*, 3 April 1938. Similar but more detailed words describe the Pavilion in the official presentation brochure of the World's Fair in Italy: "The bulk of the building, following the natural contours of the terrain is approximately 40 metres wide, 144 metres long, and 20 metres high, except for the façade, which rises to 45 metres. Its main façade, on one of the short sides, creates a vista toward one of the Fair's entrances. A statue of the Goddess Roma dominates the centre (an enlarged reproduction of the one found in Piazza del Campidoglio), set among bundles of stylized *lictor fasces* that elevate it to a height of 45 meters above street level. Beneath the level of the statue, a stream of water flows along a staircase 11 meters wide, until it cascades into a large mirror-like pool framed by two portico wings, that lead to the Pavilion's entrance via two flights of stairs. In front of the pool stands the grand monument to Guglielmo Marconi, conceived and executed by Academician Dazzi, which in its entirety must measure over 8 meters in height". *L'Italia alla Esposizione Universale di New York 1939* (1938).

12 Michele Busiri Vici (Rome, 1894-1981), engineer and architect, after graduating from the Rome Higher Institute of Engineering, dedicated himself to both architectural design and urban planning (urban coastal plan for Sabaudia). See Muntoni, Neri 2017.

13 For further information, see Laghi 2012, 109-24, which draws extensively from the Donazione Dazzi to the Comune di Forte dei Marmi. The legacy and reflections resulting from the commissions of Dazzi's era are still partially unresolved. While the 1923 Vittoria ai Caduti arch in Genoa was largely restored in the post-war period, the colossal structure *L'Era Fascista* (Il Bigio) created in 1932 for Piazza della Vittoria in Brescia was accepted, and the proposal for its removal after the 2013 relocation caused such a controversy that the authorities discontinued the project. For further reading on the issue, see the interesting contribution by Carter 2024.

14 Initially Marconi should also have been commemorated with an exhibition of his artefacts and inventions, in a hall on the first floor. The exhibition did not later take place, perhaps due to the simultaneous presence of the Marconi relics at the *Mostra di Leonardo da Vinci e degli inventori italiani* organised at the Palazzo dell'Arte in Milan from May to October 1939. See *L'Italia alla Esposizione Universale di New York 1939* (1938), 33.

> monument of such grandeur that all of the Egyptian and Roman columns that rise up in the squares and forums of Rome would, in terms of proportions, recall the vision that he had conceived and that the Duce had already approved. While the plinth of the Marconi *Radio* statue is very similar, Marconi is portrayed in a more heroic manner. Given that the symbolic statue towers above the plinth, it would have been impossible to adopt a more realistic, portrait-like form below without generating a conflict in style. Marconi, with his Herculean, youthful neck, focused and steadfast, is truly the symbol of an almost natural strength placed at the service of all humanity. (Biancale 1939, 775; italics in original)

Regarding the commission and the meaning of the work itself Dazzi wrote:

> My idea is to honour Marconi's genius, not with a personal monument to him, but with a monument to his invention, his works – alive, true and everlasting. My monument does not seek to be a commemoration, but an anthem to life that is always present, current, the essence of humanity. The heart which is the symbol of reality and hope combined; the heart which signifies joy and pain, love and hate, peace and war. The shapes of a man and the signs of his spirit, but the whole of his spirit. Glorifying the work of art therefore means making a monument to the personal and immortal aspects of Marconi. Here is my plastic figurine. The young maiden around the world holding a heart in her hand; that of humanity. (Dazzi 1979, 68-9)

Dazzi's admiration for Marconi was evident in the words he expressed after Marconi's death:

> Just returned from Paris in the summer of 1937, Marconi had died and I was far from Rome meaning I could not attend the honours paid to the illustrious scientist… how young I was at the station in Rome, among the crowd of admirers pushing the carriage that carried him to the glory of Campidoglio.[15]

The spiritual zeal expressed by Dazzi seems to predict the subsequent endeavour of the monumental Marconian obelisk, commissioned by Mussolini in person for the Rome World's Fair in 1942. The Fair never took place and the creation of the obelisk was dragged out until 1959.

In the meantime, the fame of Marconi and also of the places connected to him was sealed with the help of a new law enacted on 20 June 1939 to protect places of natural beauty which also extended to Villa Griffone in Pontecchio, which two years later would house the remains of the inventor.[16]

1939 offered another chance to celebrate and represent Marconi, by now in the Pantheon degli Scienziati Italiani, on the occasion of the exhibition *Mostra di Leonardo da Vinci e delle invenzioni italiane*, which took place in the Palazzo dell'Arte in Milan from May to October. In fact, they were two closely connected propaganda exhibitions; the *Leonardesca,* curated by Giorgio Nicodemi, indeed created the national-popular myth of the predecessor genius of Leonardo, later passing the baton to the *Mostra delle invenzioni,* directly coordinated by the CNR (Giorgione 2019b). The connection point was the Sala della Celebrazioni, set up by the painter Francesco del Pozzo, "to honour the Greats with the recognition they deserve from their country, through the exhibition of their artefacts which, from Leonardo to Galileo, to Volta, to Marconi, have irradiated the immortal name of Italy throughout

15 It was actually Marconi, as President of the Accademia d'Italia, who accepted Dazzi's oath on the occasion of his nomination and swearing in.

16 Regarding the new laws on protection of cultural and landscape heritage, see Grisolia 1939, 213-26.

Figure 5
Anonymous illustrator, *L'Italia alla Esposizione Universale di New York*. 1938.
Milano, Archivio Museo Nazionale Scienza e Tecnologia Leonardo da Vinci

Figure 6
Gottscho-Schleisner, Inc., *New York World's Fair: Il Padiglione Italiano con la cascata e le due sculture di Arturo Dazzi: la Radio col cuore in mano e il ritratto di Guglielmo Marconi*. 1939. Washington, D.C., Library of Congress, Prints & Photographs Division, Gottscho-Schleisner Collection [LC-G605-CT-00416-1/2]

Figure 7
Fay Sturtevant Lincoln, *New York World's Fair. Veduta generale del Padiglione Italiano.* 1939. Fay S. Lincoln Photograph collection, 1920-68, HCLA 1628, Special Collections Library, University Libraries, Pennsylvania State University, b. 881, no. 30

Figure 8 *La Radio col cuore in mano* (life-size model) together with plaster models of the Marconian stele in the studio of Arturo Dazzi. 1939-40. Forte dei Marmi, Donazione Dazzi

Figure 9 Arturo Dazzi in his studio with the portrait of Marconi for the shrine of Pontecchio. 1940-41. Forte dei Marmi, Donazione Dazzi

Figure 10 Benito Mussolini pays tribute to the bust of Guglielmo Marconi. 1941. Istituto Luce/Gestione Archivi Alinari, Firenze

the world" (*Mostra di Leonardo da Vinci e delle invenzioni italiane* 1939, 11-19). The Hall showcased a historical exhibition of the artefacts and replicas which made up the *Documentario dei Primati Italiani* that the CNR had created for the previously mentioned Chicago World's Fair in 1933 and which from 1937 had been housed in the Institute's new Rome subsidiary: among these were the Marconi relics,[17] beginning with the famous replica of the Detector in a cigar box.[18] The installation design included a giant-scale reproduction of Alessandro Volta's battery and at the end of the hall, in a sort of apse, the

> shrine dedicated to Guglielmo Marconi, capped with a dome upon which, at intervals, there appears a luminous S.O.S. on the waves of a stormy sea. The mask of the supreme inventor is positioned on a stele in the middle of the semi-circular space amplifying the sense of emotion that pervades the entire intimate and evocative atmosphere of the shrine. (*Mostra di Leonardo da Vinci e delle invenzioni italiane* 1939, 12)

There are no photographs documenting this installation, nor do we know who created the mask, but the use of the term shrine (*sacrario*) no less than twice in a few lines and the alignment to figures such as Leonardo, Galileo and Volta, had clearly transformed Marconi's public image, less than two years after his death.

Let's return to the commission of Arturo Dazzi's commission for the monument to be showcased at the World Trade Fair in 1942,[19] an obelisk to be erected in what would have been named Piazza dell'Impero. Planning began for the masterpiece, with preparatory casts, in conjunction with the New York monument, as shown in a photograph[20] where the sculpture can be made out under a canopy **[fig. 8]**, either a model or the actual work, of *La Radio col cuore in mano*, along with a series of plaster cast elements that can be identified by some of the obelisk panels or by the Marconian stele (Laghi 2012, 125-38).

This monument should have completed the recognition of Marconi's genius together with the conquests and achievement of fascist Italy, and the shape of the obelisk integrated, as clearly highlighted by the artist, an ancient form with the modern concept of the antenna, executing the actualisation of 'Roman culture' which was one of the foundations of the regime's propaganda. In 1940, before Dazzi had suspended the project,[21] many plaster reliefs had already been completed and were described in an article by Biancale entitled *Nel cantiere di Arturo Dazzi*,[22] in which he praised Dazzi's "sculptural titanism".

At the same time, Dazzi had the opportunity to work on another important commission for an official monument that depicted Marconi, on the occasion of the construction of the shrine dedicated to him at Villa Griffone, designed by Marcello Piacentini and unveiled by Mussolini in the

17 These are the same artefacts that were later donated to the Museum in 1956 for the set-up of the Sala Marconi, and which are covered in the essays in this publication, see ASMUST, Allestimento Sezioni Museali, Telecomunicazioni, 5.

18 Regarding this matter, see the essay by Roberta Spada, *infra*.

19 For further discussion, see Canadelli 2019 and related bibliography.

20 Forte dei Marmi, Donazione Dazzi.

21 The works were suspended in August 1943 due to "unanticipated causes of war", nullifying the work of four years.

22 "One moves from the ethereal song of the Italic virgins, positioned in the interplay of suspended bodies and in an almost sonorous tapering, like the pipes of an immense organ, to the life of the oceanic creatures, to their dances, which shield the splashing from their polished bellies in the shadow of camels and elephants" (Biancale 1939).

middle of the War, on 7 October 1941. The plinth of the Marconi bust, which Dazzi sculpted[23] in Carrara marble **[fig. 9]** was positioned in perfect alignment between the Mausoleum and the Villa, with a hieratic tone of a modern prophet, to which Mussolini paid homage, as documented in the photographic report by Luce **[figs 10-11]**. When reviewing the monument in *Emporium*, Attilio Crespi wrote a few succinct phrases:

> The bust looks towards the Reno valley. With the skill of a master, Arturo Dazzi has sculpted the features of the deceased, pouring the light of his poetic soul into his materials: a physical and moral portrait, likeness and transfiguration. (Crespi 1941)

With the fall of fascism and the final stages of the war, Dazzi's position, which had been so closely linked to the regime's[24] commissions, plummeted. On his return to Forte dei Marmi, Dazzi found his studio destroyed, "a contract no longer valid and souls that were too desperate to care about Guglielmo Marconi and his monument" (Laghi 2012, 129).[25] From as early as 1947 the sculptor, acting entirely independently, resumed work on the obelisk, and it was only in 1954 that the Consiglio Superiore dei Lavori Pubblici approved its completion as part of the urban planning programme for the EUR district. The Carrara sculptor was therefore able to see his most troubled work come to fruition and, 20 years after its commission, the *Marconian Stele* (or antenna, as the artist preferred to call it) was unveiled on 11 December 1959 in the presence of government representatives and members of the Marconi family **[fig. 12]**. Having abandoned the rhetoric of fascist representation, the project brought to light the 'symphonic poem', which in reality had already existed since its conception. The figures are immobile and suspended, almost symbolists, carriers of a message of peace and brotherhood, as is evident from the artist's words at the official presentation of the monument, reported by his friend Carlo Carrà:

> It is in the marble of these panels that, with the emotion of an artist engaged in the spirit of his times, I wanted to sculpt the magnificent poem of radio, in all its social and civil aspects, in all its great moral, practical and humanitarian dimensions. I wanted to express, demonstrating its countless benefits, the richness of human content that almost renders this scientific invention divine; because if it's through radio that words and melodies have gained wings to spread human thoughts and the harmonies of their musical spirit around the world, it's also thanks to radio which, in seas and deserts, in Arctic solitude, in floods, plagues, earthquakes and wars, provides shelter for desperate lives under the wings of a continuous diligent protection. An invisible guardian Angel now watches over the world, and it was Marconi who gave it to us. (Dazzi, Carrà, De Lorenzi 1993, 5)

The piece, which is made up of 92 marble panels **[fig. 13]**, measures 45 metres in height with a square base of 5 metres per side: the themes, as mentioned, are all of spiritual and symbolist evocation, such as *the Love Songs, the Dances, the Voices of the Radio, the Hunt, the Flood, Holy Saturday* – culminating, at the pinnacle,

23 At the Donazione Dazzi in Forte dei Marmi the model is preserved in plaster.

24 In 1941 he again collaborated with Piacentini on the relief *La giustizia biblica* in the Palazzo di Giustizia in Milan.

25 The scholar reconstructs in detail the events surrounding the completion of the work, citing extensive passages in the correspondence between Dazzi and Marcello Piacentini, the friend and colleague who made a substantial contribution to getting legal approval for the completion and location of the work at the EUR. On the relationship between the two artists, see Di Trapani 2020.

Figure 11
Mussolini, other fascist authorities and the Marconi family leave the shrine after paying their tribute. 1941. Istituto Luce/Gestione Archivi Alinari, Firenze

Figure 12
Arturo Dazzi with his wife Andreina 'Gri', Marconi's widow, and their daughter Elettra at the inauguration of the Marconi stele. 1959. Istituto Luce/Gestione Archivi Alinari, Firenze

Figure 14 Vincenzo Jerace, *Busto di Guglielmo Marconi*. 1940. Roma, Consiglio Nazionale delle Ricerche. © Author

Figure 13 Arturo Dazzi, *La stele o obelisco marconiano nella piazza a lui dedicata* (dedicatory inscription on north-east face). 1937-59. © Author

in the figures of *Christ resurrected* and Marconi himself, depicted as a sort of lay priest. Dazzi's sincere affection and empathy for Marconi go hand in hand with his liberation from the post-war burden of his ties to fascism, and the myth of the inventor, now emptied of autarchic rhetoric, adapts by transforming itself into a kind of manifesto for peace and brotherhood through radio.

To conclude this essay, we return to the bust sculpted by Vincenzo Jerace in 1940. The Museum cast, repainted at an unknown time in a dull, greyish patina that has covered the original polish, does not reveal the fullness of the undulations and the values of light and darkness in the work, which sets it apart both in composition and style, from the heroic portraits of Dazzi and Roscioli. The clumsy intervention was probably carried out following damage that also altered some details, as is evident when we compare the work to the original preserved at the CNR **[fig. 14]**. The modelling not only seems more confused, but also lacks the detail on the right hand resting on a globe.[26] Moreover, the front of the plinth was carved with a scene depicting a row of antennas in perspective, crowned by an arch of waves which, like a rainbow, flows directly from the Lupa capitolina on the bottom left, according to the idea already portrayed by Dazzi, although in a completely different style, of the capability of radio to transmit messages from Rome to the rest of the world.

In planning a hall dedicated to Marconi,[27] Guido Ucelli intended to represent the scientist, as shown by a letter he wrote to Vincenzo Rolla, secretary of the CNR, on 21 March 1956, in which he stated, "in this respect I would like to know if it is possible, to procure the bust of Guglielmo Marconi for the Museum that was displayed in Genoa for a permanent installation".[28] Ucelli was referring to the *Mostra dei cimeli marconiani* that had been held in Genoa in 1955, at the Teatro del Falcone,[29] curated by Gino Montefinale, who had collaborated with Marconi regarding the experiments on board the *Elettra*. The bust of Marconi arrived in Milan on 7 June 1956 along with the *Elettra artefacts*, which were the property of the Ministry of Post and Telecommunications, and both were granted on temporary loan.[30] The work was recorded at the end of the list as "Busto di Marconi in gesso, proprietà del CNR, donato dal prof. Jerace" (Bust of Marconi in plaster, property of the CNR, donated by Prof. Jerace). For this reason, Ucelli decided to have a cast made before it was returned to Rome, calling Cesare Gariboldi whom he knew well because of his work at Brera. Gariboldi created the casts in August 1956,[31] in time for the installation of the Marconi Exhibition Hall which was inaugurated on 10 October the same year. In the inauguration speech, Gustavo Colonnetti, president of the CNR, recalled that "Italy occupies

26 The future restoration of the cast will aim to eliminate the repainting and bring out the original engravings and patinas of the cast.

27 For matters related to the composition of the collection of Marconi relics and their exhibition, refer to the other essays in this volume.

28 ASMUST, Allestimento Sezioni Museali, Telecomunicazioni, Sala Marconi 5 and again in Corrispondenza II Serie, busta 76, letter from Guido Ucelli to Francesco Rolla.

29 In relation to this, see Montefinale 1955. The CNR had loaned its artefacts, already exhibited at the seat of the Presidency. In the catalogue there is however no mention of the bust.

30 ASMUST, Museo Industriale, Esposizioni, 17 (Materiali ex documentario CNR), 7 June 1956, List of Marconi relics already belonging to the yacht *Elettra* and temporarily delivered to the Museum, countersigned by Federico Morelli, general secretary of the Museum, and by Vincenzo Rolla for the CNR.

31 ASMUST, Mandati di pagamento, b. 33, 1956. The orders were signed on 8 August, for a total cost of 42,000 lire (20,000 lire for the Marconi bust, 7,000 lire for the relative bracket, 15,000 lire for the bust of Volta). The work was paid for on 20 August, a date prior to the execution and delivery.

an unmistakable position in the history of culture and thought; a position that Marconi has widely and worthily contributed to highlight before men of all countries and all times".[32] It is not known how long Jerace's bust was displayed in the artefact exhibition room on the *Elettra*, but with the return of those artefacts to the Ministry of Post and Telecommunications and the rearrangement of the Section, it is probable that it had already been moved to the entrance, at the end of the long corridor of the Gallerie Leonardo, where it was still located in 2000, before the last reorganisation. Perhaps it was no longer the time to represent Marconi with a work connected to different times, narratives and contexts. Nevertheless, within the collection, Vincenzo Jerace's bust can still serve as a fine testament to this type of representative instrument for the portrayal of the scientist-hero who played a fundamental role in the representation of his own myth beyond his death.

32 *Museo Nazionale della Scienza e della Tecnologia Leonardo da Vinci. La Sala Marconi. Le sezioni Radio e Telecomunicazioni* 1956, 16. The cast of Jerace's bust opens the small publication on p. 3, next to a photograph of the first cloister of the Museum.

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Other Marconi Collection Objects and Documents: A Selection

In addition to the numbered series presented in the previous pages, there are many other objects linked to Marconi in the MUST collections that provide inspiration for further research and stories. We present a selection that documents a variety of fields which involve the complex history of wireless communication, namely scientific research, transport, geolocation, the wartime era, and the media. They represent the diversity of the industrial sectors in which the various branches of the Marconi Company operated in the 1900s. The artefacts have differing origins, but a significant group comes from the Raccolte Storiche del Comune di Milano – Civico Museo Navale Didattico (CMND), whose collections were exhibited at the opening of MUST (Ronzon 2006). Some of these objects were probably actually used, while others appear to have the same demonstrative purpose as the 'artefacts' that came from Marconi's companies, so a common origin is likely. Finally, the Museum's historical heritage also includes archival documents, and an extensive series of volumes dedicated to Marconi and the history of wireless communication. Here we present a small selection that records the construction of the Marconian myth.

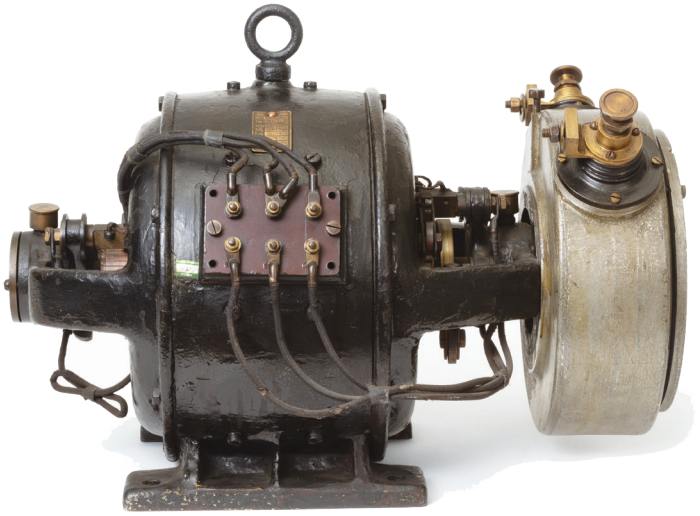
Battery of six condensers or ‘Leyden jars’
inv. IGB-009894
Era of technology: post 1897
Manufacturer: MWCT (Chelmsford) and Officine Radiotelegrafiche Marconi (Genoa), post 1909
Provenance: unverified

The Leyden jar was a type of capacitor with a long history. It was developed around 1745 with the contribution of various scientific experimenters and received its name from the Dutch city where public demonstrations of its properties were held. At the end of the 1800s, it was a common instrument in electricity laboratories. It became part of the collection of Marconi’s early wireless transmitters, both in experimental apparatus and in the first commercial installations. The artefact is marked with the name of the Marconi’s English parent company on the jar lids and the name of the Officine Marconi (Italian workshops) on the container. This leads us to suppose that the set was assembled after the opening of the Italian workshops in 1909 (Pietrangeli, *infra*).

Wave meter ‘Direct Reading Cymometer’
inv. IGB-009888
Era of technology: 1906
Manufacturer: MWTC (London), post 1906
Provenance: unverified

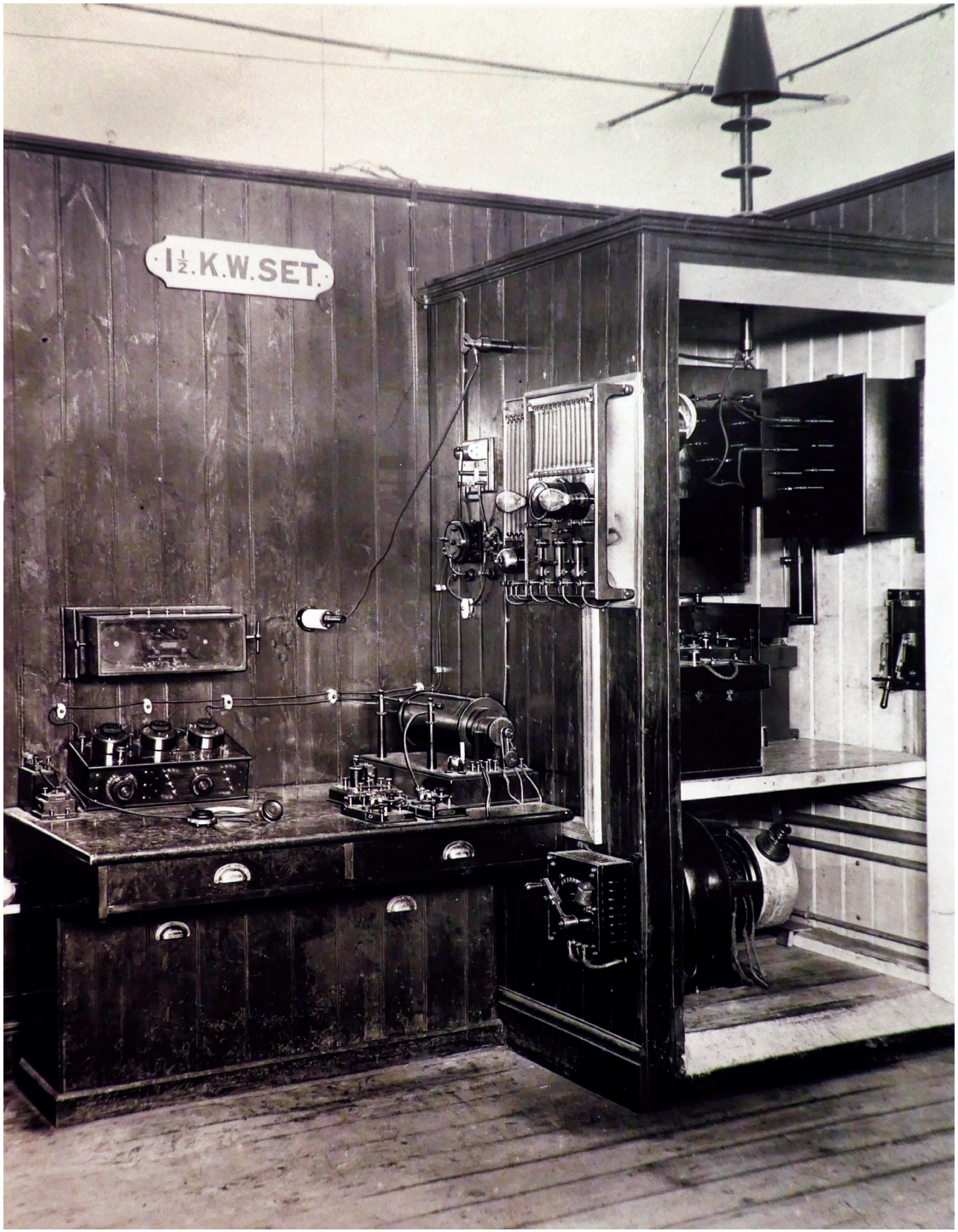
Original instrument for measuring wavelengths, created in 1905 by the famous British engineer and scientist John Ambrose Fleming (1849-1945), who had been working as a scientific consultant for the MWTC since 1899. It was designed as a ‘portable’ instrument (Fleming 1906, 406). This artefact is a 1906 model that bears the series no. ‘99’. The instruction manual states that it was produced in the Marconi workshops in the London district of Dalston and specifies that the instrument could be used “without the slightest skills”. It was not only useful for telegraphy, but also “demonstrating in an elegant manner the laws of electrical resonance and is particularly suitable for this purpose for class or lecture demonstrations” (*Instructions*, 1906-07, 4, OBL MS Marconi 1210). Like the previous artefact, the ‘cymometer’ (a term coined by Fleming himself) reflects how electromagnetism in the early 1900s was an object both of laboratory study and a field for industrial development.

Antenna tuner (jigger secondary or transformer)
inv. D-000071
Era of technology: early 1900s
Manufacturer: Regia Marina italiana (?), date unknown
Provenance: Comune di Milano, date unknown



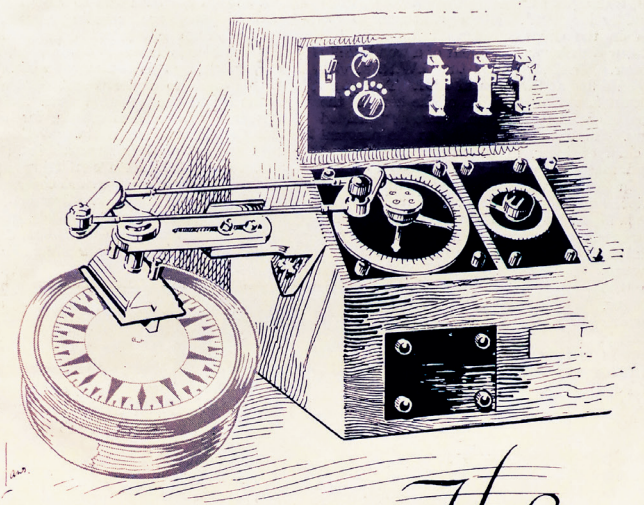
Rotary spark gap for radiotelegraphic station of 1,5 kW
inv. D-000073
Era of technology: 1907
Manufacturer: MWTC (?), post 1907
Provenance: CMND, undated

The photographs show two elements from a naval radiotelegraphic station displayed at MUST, perhaps partly produced in Italy with the authorization of the MWTC (see Balbi, *infra*). The tuner bears a plate with the inscription "Divisione di Artiglieria" (Artillery Division). We can analyse these objects using MWTC promotional material. On the right is a photo depicting the exhibition setup of a naval radiotelegraphic station at the beginning of the 1900s (OBL MS photograph d74). The back of another promotional postcard of the time (not pictured) shows in detail the interior of the insulated cabin and also gives a description: "Marconi 1 ½ K.W. Ship Set. Interior of Silence Cabin. The set illustrated is fitted on most of the Atlantic [li]ners and on passenger boat generally [sic]. Current is supplied from the ship's mains to a rotary converter, which charges the condensers through the jigger primary by a rotating disc with projecting studs which pass in close proximity to a pair of fixed electrodes. This disc, which gives to the signals a clear musical note […] is enclosed in an aluminium casing. The aerial is brought through the roof of the cabin to the Aerial inductance and to the jigger secondary to the earth plate. A parallel rod sliding inductance is provided for final adjustment of wavelength" (HSM inv. 13905).


1½.K.W.SET.

‘Marconi-Bellini-Tosi Direction Finders’
inv. IGB-002232 and inv. CMND-002546
Era of technology: 1912
Manufacturer: Officine Radiotelegrafiche Marconi (Genoa), post 1912
Provenance: CNR, 1956 and CMND, undated

Original instruments for determining the position of ships at sea and tracking their routes. When used in conjunction with ship wireless telegraphy equipment, they allowed operators to establish the direction of the wireless signals coming from remote transmitting stations, and therefore to locate the ship position (*Instructions*, undated, OBL MS Marconi 1213). The two artefacts were almost certainly manufactured in Italy. A system that used the new wireless technology to determine position at sea had already been patented in 1902 by Alessandro Artom (1867-1927). In the same period MWTC too got interested in this possibility, which it believed to be lucrative on a commercial level, and promoted internal research (Cuthbert Hall, 1901). The final device was later developed by two officers of the Regia Marina Italiana (Royal Italian Navy), Alessandro Tosi (1866-1936) and Ettore Bellini (1876-1943), who designed a new prototype in France from 1907. Their patent was purchased by the MWTC in 1912 (Baker 1970, 150). Direction finders became a flagship product for the Marconi maritime sector, used on transatlantic ships, fishing boats and later airplanes. They were the focus of large marketing and demonstration investments. Here, to the right, is a 1923 advertisement (OBL MS Marconi 1390).



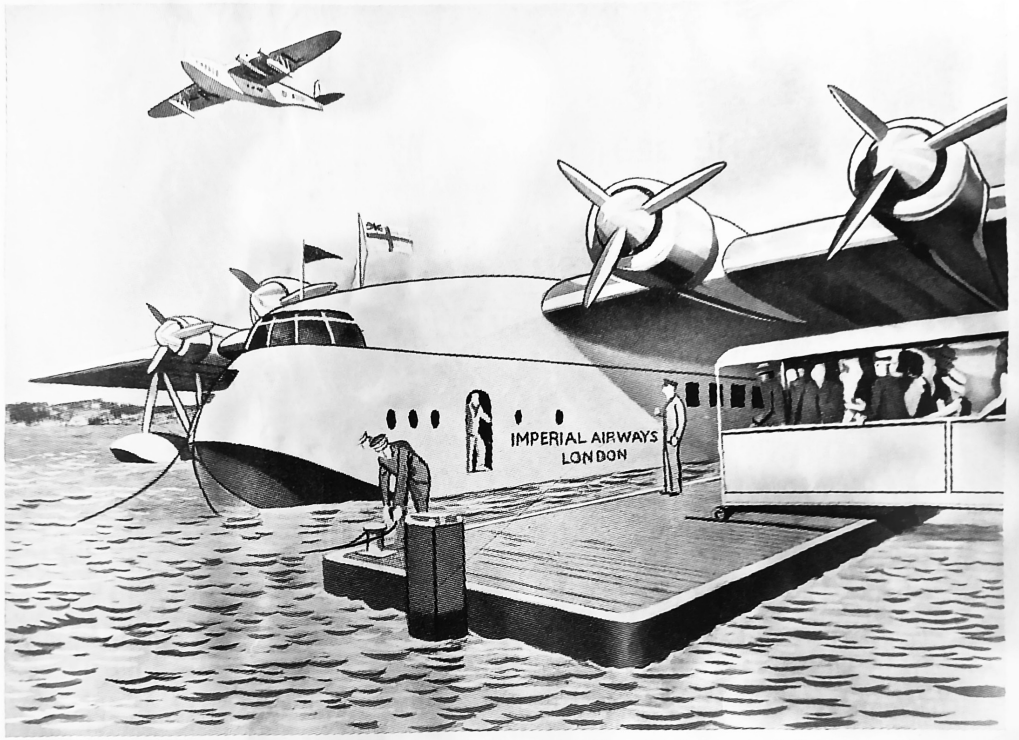
The MARCONI DIRECTION FINDER IS AN INSTRUMENT OF PRECISION, AND AS AN AID TO NAVIGATION IS INVALUABLE.

The MARCONI INTERNATIONAL MARINE COMMUNICATION CO., LTD.
MARCONI HOUSE, STRAND, LONDON, W.C.2

Portable aircraft transmitter ‘Marconcina’
inv. IGB-009886
Era of technology: post 1915
Manufacturer: Officine Radiotelegrafiche Marconi (Genoa), post 1915
Provenance: unknown

This transmitter was the result of collaboration between Guglielmo Marconi and the technicians of the Italian Armed Forces, whose operational requests prompted the modification of aircraft apparatus designed by the MWTC in England. In the summer of 1915, the Italian army independently launched an experimentation project on unidirectional aircraft-to-ground communications to assist the artillery and improve striking precision. It was on this basis that Marconi, who had enlisted as a lieutenant in the Italian army, was called upon to become involved and help meet the needs of the military. The collaborative project produced this model of transmitter, which was later mass-produced in Genoa (Colavito 2020, 10). The artefact highlights the two most important sectors of industrial development for the MWTC which were destined to expand in the following years: the fields of military application and aviation. On the right, a cutting of a 1934 advertisement (OBL MS Marconi 1394).

MARCONI AGAIN



An artist's impression of one of the new flying boats reproduced by kind permission of Imperial Airways

For their new fleet of aircraft, Imperial Airways have again chosen Marconi equipment . . . already so successfully used in their existing passenger fleet.

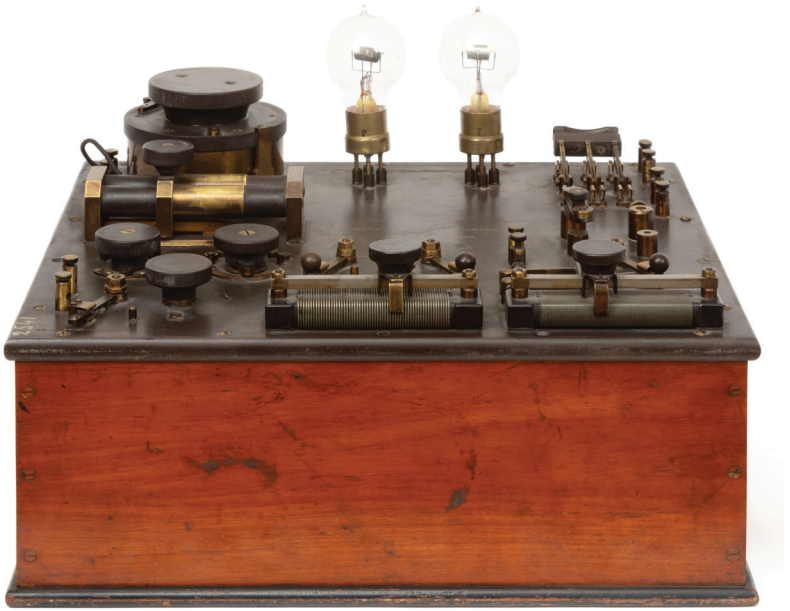
WHY EXPERIMENT?—CONSULT

MARCONI

Marconi equipment is in regular service on civil, military and naval aircraft and for aerodromes in more than 30 countries. However difficult your requirements Marconi's can provide adequate service and equipment.

Valve transmitter for naval stations
inv. CMND-002571
Era of technology: post 1919
Manufacturer: Officine Radiotelegrafiche Marconi (Genoa), post 1919
Provenance: CMND, undated

Transmitter fitted with M.T.4.A triodes (thermionic vacuum tubes with three electrodes, Keilth 1999, 69 fig. 7.4) based on the original version produced by the Marconi-Osram Valve Company founded in London in 1919. It was able to produce sustained electrical oscillations (at a steady amplitude) and a predefined frequency. This kind of transmitter was part of the wireless equipment defined as 'new generation' in advertisements at the time (adjacent, on the left, a cutting from *The Electrician*, 28 July 1922, OBL MS Marconi 1390). The Marconi devices were not sold but the company usually provided leasing and operational management services. The Marconi International Maritime Company highlighted security aspects, and the global scale of the service offered (adjacent, a page from *The Wireless World and Radio Review*, 12 August 1922, xviii).



Crystal receiver with valve amplifiers
inv. D-000076
Era of technology: post 1906
Manufacturer: Officine Radiotelegrafiche Marconi (Genoa), post 1906
Provenance: Comune di Milano

Receiver with carborundum (silicon carbide) crystal detector with two thermionic valves (triodes) for signal amplification (similar to artefact D-000022). It consists of a wooden box with a top made of ebonite, an insulating material. The two crystal holders with interchangeable mounts are located on the top side along with one sliding capacitor, one rotating capacitor, two rheostats, various wire clamps and switches made of brass. John Ambrose Fleming in 1904 proposed to use thermionic vacuum tubes (initially, diodes with two electrodes) as electromagnetic wave detectors. The system was immediately adopted by Marconi. Diodes served as the foundation for American Lee de Forest to develop and patent in 1906 the triode, his three-electrode valve named ‘audion’, which later paved the way for broadcasting (Hong 2001, 119 ff.).

‘Round Triode’ Valve
inv. IGB-002189
Era of technology: post 1913
Manufacturer: MWTC (Chelmsford), post 1913
Provenance: Eugenio Gnesutta, 1955

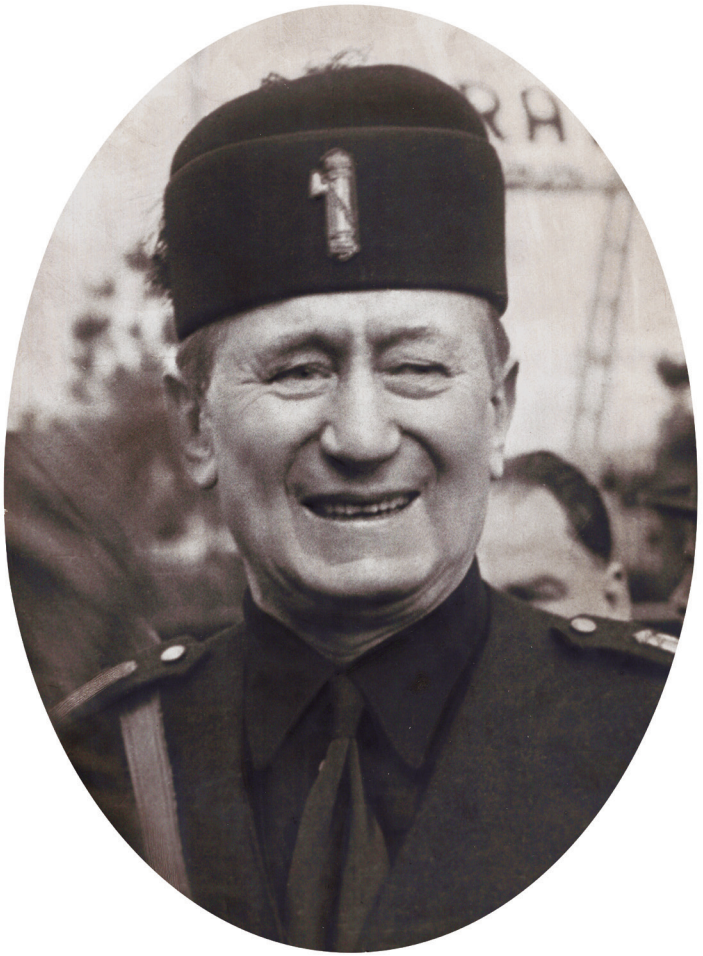
Three electrodes thermionic valve (triode) for continuous wave transmission, designed by Henry J. Round, an MWTC engineer, who was granted patent no. 28413 in 1913. In the same period, other engineers in the leading wireless communication industries (such as Telefunken, General Electric, AT&T, Westinghouse) were also patenting new types of valves. They had discovered that these devices, created by John Ambrose Fleming and Lee de Forest (see the page aside), and already present on the commercial market as wireless signal receivers, could also be used as oscillators and thereby be used for transmission. This discovery formed the technological foundation upon which broadcasting was developed (Hong 2001, 155-6).

50kW RCA Radio Broadcast Transmitter
inv. IGB-008333
Era of technology: 1932
Manufacturer: Radio Corporation of America, post 1932
Provenance: Rai, 1972

RCA (Radio Corporation of America) radio broadcast transmitter, part of the station of the Ente Italiano Audizioni Radiofoniche (EIAR, the state-owned radio broadcasting company) in Siziano (Pavia). This artefact is closely linked to the history of the Marconi companies. RCA, in fact, was the name assumed in 1919 by the company formed from the merger between the Marconi Wireless Telegraph Company of America and the General Electric Company of America (Baker 1970, 180). EIAR developed from the earlier Unione Radiofonica Italiana (Italian Radiophonic Union), the first national broadcasting company set up in 1924 in collaboration with a subsidiary of the Marconi Company (Monteleone 1992, 19). Subject to subsequent modifications, this transmitter operated from 1932 to 1969. It became a museum piece in 1972 (Spada 2024).

Marconi Mark3 Television Camera BD687
inv. IGB-016001
Era of technology: post 1947
Manufacturer: MWTC (Chelmsford), post 1947
Provenance: Rai, 2004

MUST inventory records reveal that this video camera was used in the Rai studios from the mid-1950s to around 1970. The MWTC began to produce television cameras starting from 1947, with Orthicon type imaging tubes, which also allowed recording in low light conditions (Baker 1970, 363). The front part features a rotating turret on which were mounted lenses of varying focal lengths, as zoom optics were not yet available. Like the RCA Transmitter (see aside), this artefact also accounts for the expansion of the Marconi Company into the sector of radio and television broadcasting. This field only emerged late in the inventor's career and developed somewhat independently of his initial interests (Balbi 2017).



Reproduction of a Marconi portrait mounted on cardboard with hand-cut edges, undated

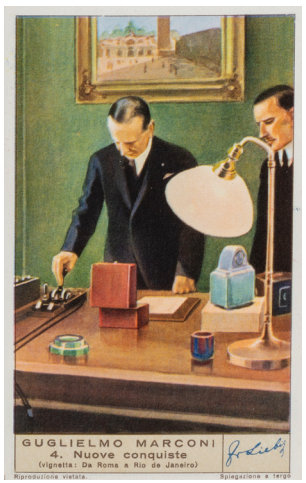
In the MUST archives there are a number of enlarged period images portraying Marconi or Italian radiotelegraphic stations. They were most likely used for exhibitions, as they appear to be cut out and mounted on cardboard. The origin is unknown, but it could be part of material used in display contexts prior to the Museum's foundation. ASMUST, Archivio fotografico.

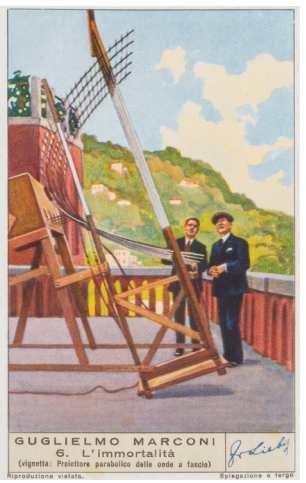
Model of the yacht *Elettra*
inv. D-000219
Era of technology: 1904-19
Manufacturer: unknown
Provenance: CNR, 1956

Scale model of the yacht that Marconi purchased in 1919 to be fitted out as a mobile laboratory. Built in Scotland in 1904 and originally named *Rovenska*, Marconi rechristened the vessel *Elettra* (Raboy 2016, 437). In Italy it became one of the artefacts that best represent his enterprises, and that persists in contemporary iconography. The television series, *Marconi. L'uomo che ha connesso il mondo* (Marconi. The Man Who Networked the World) (2024), was broadcast by Rai on the occasion of the 150-year anniversary of the inventor's birth and featured a reconstruction of the yacht as one of the main settings of the story. The model housed at MUST was part of the group of 'relics' received from the CNR which arrived in Milan in April 1956 (Casonato, Spada, *infra*).

Capt. Wilbur Lawton (John Henry Goldfrap) (1914). *The Ocean Wireless Boys on the Atlantic*. New York: Hurst & Company.

A novel for teenagers from the *Ocean Wireless Boys* series. The author, a film producer writing under a military pseudonym, created a series of adventure stories centred around the aspirations of teenage boys to become radio operators (Moving Picture World 1917, 1467). The book documents the fascination of the era with new wireless technology and the heroic aura that surrounded its operators, and more generally young radio amateurs. The protagonist is, in fact, a boy from humble origins, who due to his courage and technological skills gained from experimenting with homemade apparatus, becomes employed as a 'wireless boy' on board a large ship. The book was acquired by the MUST library in 2024.





Collectible advertising cards, series dedicated to the life of Guglielmo Marconi, Compagnia Italiana Liebig S.A., second half of the twentieth century

Series of six collectible advertising cards featuring some of the well-known episodes in Marconi's life and in the development of wireless technology. The back of the card carries a description of each moment that is depicted, using a dramatic tone to highlight the ingenuity of Marconi, and of Italian scientists in general: "Along with Luigi Galvani and Alessandro Volta he completes and embodies the quintessentially Italian trio to whom the world owes the discovery of electricity and its subsequent, miraculous inventions and applications" (card 6, transl. by the author). The Liebig cards started to be distributed in France from around 1870, and were later also circulated in other countries, as a free gift when purchasing Liebig products. They were produced until 1975 (Sanguinetti 2018). The Marconi series is currently being acquired by MUST as evidence of the widespread circulation of the 'inventor legend' which accompanies accounts of Marconi.

Marconi in front of a show case displaying his ‘historical devices’, alongside his assistants George Kemp (on the left) and Percy Paget (on the right), in the 1930s (OBL MS photograph 238)

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The Interconnectedness of the Sources

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In the 2004 Codice dei Beni Culturali (hereafter 'Code'),[1] Art. 101, a museum is defined as follows: "A permanent structure that acquires, catalogues, preserves, orders and exhibits cultural heritage for purposes of education and study". Art. 2 of the same decree defines what the law means by 'cultural heritage':

> immovable and movable things which, pursuant to Articles 10 and 11, present artistic, historical, archaeological, ethno-anthropological, archival, and bibliographical interest, and any other thing identified by law or in accordance with the law as testifying to the values of civilization.

What immediately stands out in this wording is, on the one hand, the absence of specific reference to historical-scientific heritage, and on the other, the use of the expression developed during the work of the Commissione Franceschini in 1964,[2] "testifying to the values of

This contribution was made possible through research carried out during a visiting fellowship at the Max Planck Institute for the History of Science in Berlin.

1 Legislative Decree No. 42 of 22 January 2004, Codice dei beni culturali e del paesaggio, pursuant to Article 10 of the legislation of 6 July 2002, No. 137 (`https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:2004-01-22;42`). Cataloguing was not mentioned in the original text and was later introduced by Legislative Decree No. 62 of 26 March 2008. Further supplementary and corrective provisions related to cultural heritage were added to Legislative Decree No. 42 of 22 January 2004.

2 The Commissione d'indagine per la tutela e la valorizzazione del patrimonio storico, archeologico, artistico e del Paesaggio (Commission of Inquiry for the Protection and Enhancement of Historical, Archaeological, Artistic, and

civilization" (Ainis 2009). As noted by constitutional law expert Michele Ainis, this expression for the first time abandons the traditional typological specification of the various components of cultural heritage[3] inherited from previous legislation in 1909 and 1939 (otherwise known as Rava-Rosadi and Bottai). He instead attempts to formulate a definition that embraces the general dynamic of heritage itself, which is inherently predisposed to historical evolution.

As Ainis again notes, the legislation on cultural heritage has not always developed in a linear manner from the 1970s to this first quarter of the twenty-first century. On the contrary, we observe a series of interventions both in terms of legislation (above all regarding matters with economic consequences), and in relation to the organisation of the Ministry, which has modified its name (today Ministry of Culture), and its structure several times. In spite of all this *bailamme* (Ainis' expression meaning 'uproar'), some fundamental points were established in the Code, above all in theoretical terms. Starting with Art. 2, in fact, it is immediately evident that the wording is the result of a blend between the enumerative tradition and the innovative approach recommended by the Commissione Franceschini.

The first question to be asked therefore is: What do we mean to say by "testifying to the values of civilization"? Not all mobile or immobile things are cultural assets, but how can we distinguish those that are? The answer (according to the author) is that they are things that take on a meaningful identity in the broader or narrower context of a community, which can be expressed at different levels: local, national, international, even global according to UNESCO's declaration on world heritage. Moreover, the 2004 Code (whose subsequent amendments and additions are of particular interest to us, as will be seen) also stipulates that the value of a cultural asset should be defined by means of specific procedures conducted by ministerial bodies, *ex officio*, or at the request of the owners or holders (if the asset belongs to a private party).

Furthermore, with regard to cultural heritage in general, Art. 2 of the Code states in Section 2 that "the protection and enhancement of the cultural heritage shall concur to preserve the memory of the national community and its territory and to promote the development of culture". For that matter, when speaking about memory, there is an implicit reference to identity: a person who loses their memory also loses, to a greater or lesser degree (depending on the extent of the amnesia), all or part of their own identity: the same occurs to a social entity.

The UNESCO conventions of 2003 and 2005 address identity (and the right to safeguard memory as a cultural right based on one's identity),[4] and are clearly referred to in Art. 7 bis of the Code starting from the title: "Espressioni di identità culturale collettiva" (Expressions of Collective Cultural Identity).

It is worth adding that historical-scientific heritage, which is not mentioned in the typological enumeration of Art. 2, reappears in Art. 10, Section 3:

Landscape Heritage) was established in April 1964, and adopted the name of its president, Francesco Franceschini. It prepared an important report that laid the groundwork for the process that, ten years later, would lead to the establishment of the Ministry for Cultural Heritage and Activities. The acts, documents and other materials collected by the Commission were published under the title *Atti e documenti della Commissione d'indagine per la tutela e la valorizzazione del patrimonio storico, archeologico, artistico e del paesaggio* (1967).

3 In the framework of the Code, cultural assets are described as a component of cultural heritage, and some related general principles in Art. 1, cites Articles 9 and 117 of the Constitution as superior reference sources (section 1).

4 See Mucci 2012.

> Cultural heritage also includes, when the declaration provided for in Article 13 has been made: […] immovable and movable things, of any owner, that are of particular importance due to their connection with the political, military, literary, artistic, scientific, technical, industrial, or cultural history in general, or as testimonies of the identity and history of public, collective, or religious institutions.[5]

In the same paragraph ethnological and anthropological items are expressly mentioned, and in the following Section 4, the extensive list of objects included among the items subject to protection includes many whose scientific and/or technical nature is inherent to the object itself (ships, instruments, paleontological finds, etc.).

The 2004 Code therefore introduced the following elements (and they are currently in force):[6] the necessity of cataloguing; the reference to historical-scientific and technological assets; the reference to UNESCO conventions and the interconnectedness of the relationship between cultural heritage, memory and identity. In other words, protection and enhancement have been liberated from the strict monetary dimension of financial return – which is necessary because the preservation and utilisation of cultural heritage come at a cost – and brings to light again their ethical-social value.[7] From this perspective, ultimately, whatever type of cultural asset is a 'document', or rather a 'monument': the two terms have an area of semantic overlap, which derives from their etymology. 'Document' comes from the Latin verb *doceo*, which literally means "that which 'shows' or 'represents', 'something that serves to represent a fact'. […] The document is an *opus*, whose author, medium, and content can vary" (Carnelutti 1932, 86); 'monument' instead derives from *moneo*, which was also linked to the functions of showing, representing and serving to demonstrate a fact. We do not have to go back very far to find an interchange of the two terms: consider the first and most famous collections of medieval document editions, the *Monumenta Germaniae Historica*, or to the direct link made by Jacques Le Goff in the basic entry for "Documento/Monumento" of the *Enciclopedia* published by Einaudi (1978).

As Giovanna Nicolaj highlights:

> Originally and generally, the terms 'document' and 'monument' indicate what is needed to teach, show and prove as well as whatever serves to record and inform, and can be put to a variety of uses. Not only written documents, but also archaeological and artistic objects, fossils and archaeological layers, or photographs, recordings and so on. (2007, 22)

There is therefore a circularity, an interdependence between cultural assets whose typological differences, however, must continue to be the basis for their cataloguing/inventorying, that is to say for their evaluation and description, on which a general theory is still lacking. If there is one sector where interdependence has always been present, it is the historical-scientific heritage. Any object displayed (or displayable during the periodic renovation of museum layouts), even in a museum dedicated to science, inevitably brings with it a biographical and archival reference, because without this the object is not able to fully express its potential. While this is more easily verified for exhibitions with a purely historical

5 Art. 3, Section 3, lett. d.

6 In particular, for interest, it involves supplementary content to the Legislative Decree of 26 March 2008, no. 62. Further corrective and supplementary texts for the Legislative Decree on 22 January 2004, no. 42, in relation to cultural assets.

7 See also Ainis 2009 regarding this point.

focus, we should not overlook the type of science centre display,[8] where the historical objects, when present, have a functional role in the presentation of strictly scientific content. On the other hand, collections of scientific instrumentation or biomedical and natural history specimens have for centuries been an essential component of science teaching. In this sense, it could be perhaps said that this approach to artefacts, later implemented by science centres, precedes the concept of the historically integrated science museum (as is the case with the Museo Nazionale Scienza e Tecnologia Leonardo da Vinci di Milano). However, the existence of historical-scientific heritage, which is both archival and biographical in nature, is not only a support to 'museum' heritage in the traditional sense: it is an integral part of the Museum, both as a heritage component and as a working tool.

One final point to consider is the materiality of cultural heritage, for which the Code regulates restoration activities and conservation responsibilities: studying an *opus* identifiable as a 'cultural asset' from the perspective of its material composition and its structure, is not only important for reasons linked to restoration and conservation, or for the evaluation of its authenticity, but it is also a vital interpretative element. This aspect is even more significant for artefacts in science and historical-science museums, because many of them, conceived as *exhibits* (especially instrumentation), were then copied and/or produced in series, also by different producers, as they were used for teaching purposes and/or for communication and enhancement.[9]

This consideration is of particular importance for the objects described in this volume, and in general, for the enormous 'Marconian' historical heritage, housed at various locations in Italy and abroad, and made up of cultural assets of every type and from various periods, even subsequent to Marconi's death. To mention just a few examples: Villa Griffone and the Collina dei Celestini (a building and a landscape asset); the various archives (the main collections are at the Accademia Nazionale dei Lincei – both institutional and personal in nature – and the Bodleian Libraries in Oxford, which house the business archives of the Marconi company. Not to mention the materials still preserved by Marconi's heirs and items bought by collectors around the world, as well as the documentation related to Marconi kept in Rome in different archival holdings at the Archivio Centrale dello Stato; the instruments (main locations include Fondazione Marconi di Pontecchio, Museo Nazionale Scienza e Tecnologia Leonardo da Vinci di Milano, Science Museum in Oxford). Marc Raboy attempted a systematic census in preparing his monumental biography of Marconi (2016), but – while it produced a wealth of results – it cannot however be considered definitive. To sum up, the 150-year anniversary of Marconi's birth highlights the great quantity of work that has been carried out but also prompts reflection on how much remains to be done.

8 For the differentiation and relationship between scientific museum and science centres, see for example Schiele 2014; Alberti 2017; Bud 2017; Schirrmacher 2019.

9 Regarding this reflective piece, I am indebted to Tea Ghigo, and to her presentation on Art, Science, Museums and Heritage, at the Linacre Lecture 2024 held in Bologna on 4 May 2024. It should be added that the Marconian instruments, for example, are in this sense a case in point: created in series to be sold, but later replicated in multiple copies under the supervision of their inventor to be displayed at the Chicago World's Fair, in the museum initially affiliated to the Rome headquarters of the CNR. For the various origins of the Marconian instruments, see Casonato, *infra*, and in particular for the circumstances regarding the collections linked to the 1933 Chicago World's Fair, Paoloni, Reali, Ronzon 2019.

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Documentation of the Collections: A Historical Reading

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Historicising the Collections

The systematic study of the collections, which have formed over a period of seventy years, brings to light the different seasons that have played out in the life of the Museo Nazionale Scienza e Tecnologia di Milano, with alternating events concerning the role of objects in its cultural production.

The founding project, developed in the period between the two world wars and fully conceived during the Italian economic boom with the majority of the exhibitions being set up in the former monastery of via San Vittore, is largely tied to the acquisition of collections: thousands of instruments, machines, works of art and other materials coming from the world of research, industry and collecting, accompanied by a special library on the history of science and technology. This driving force extended to the early 1970s with the expansion of the exhibition spaces in the adjacent area that faces via Olona, with the Rail and Aeronaval pavilions entirely dedicated to the transport technology. These were years of important investment for the acquisition and installation of large object-monuments – such as trains, ships and planes – and related collections, largely made up of models (Curti 2000).

In the following decades, nevertheless, profound economic and social changes shifted the balance towards new requirements and ways of representing scientific research and innovation in public, deemed to be more suitable for tackling the challenges of imminent globalisation, the acceleration of technology and deindustrialisation (Bud 2017). Objects lost their initial appeal. The new research perspectives on the social, political and cultural implications of science and technology (along with new historiographical approaches) definitively

caused a crisis in the teleological narration of science and innovation, and also in public trust in museum institutions, something that could no longer be taken for granted (Pestre 2017). In this modified context, the rhetoric on national achievements from which technoscientific museology had originated, and on which the Milan Museum had formed its first collections, finally lost its public value (Paoloni 2018). In the same way, the encyclopaedic and universalistic intent typical of the leading national science and technology museums, such as the Deutsches Museum in Munich, which greatly inspired the Milan Museum, could hardly withstand the vastness, speed and pervasiveness of production in the second half of the 1900s. The mission of constantly updating collections in all fields of knowledge and technoscientific applications proved to be utopian (Boyle, Hagmann 2017).

The role of collections was thus called into question, not only in terms of economic sustainability, but also in terms of meaning. In the educational approach of these museums, the objects have not always played a primary role in the exhibition. They are still used on the same level as other display devices such as dioramas, reconstructions of environments and interactive exhibits. Original objects are exhibited beside reproductions or models and, as long as they are not 'relics' connected to national celebrities, they are not used for their specific story or 'biography', but as representative examples of technology, as often they are new technologies arriving directly from the manufacturing companies. The collections are not at the centre of the exhibition and the exhibition is not the result of the study of the collections (Canadelli 2019; Alberti 2005).

Hence the need, expressed in each institutional identity with its own methods and timing, to rethink the role of collections in science and technology museums, questioning the status of the cultural heritage they preserve and introducing a critical historical approach. Processes of critical self-reflection have been initiated, starting with the leading international institutions. This context has allowed the establishment of research centres or units dedicated to the study of collections, to technical-scientific museology, to the history and material culture of science and technology. The relationship between the museum and academic research has been transforming, sustaining itself with shared, co-financed projects in which knowledge and methodologies can become complementary (significant in this regard is the ARTEFACTS consortium with its associated annual conference and editorial series).[1]

Also, for the Museum in Milan the systematic study of the collections is a fundamental step which allows the improvement of the institution in many directions: research, new acquisitions, new public narratives. Turning objects into historical sources, redefining the meaning of new acquisitions, and including historical objects in the public discourse about science and technology, is the only way to restore meaning to the museum's original mandate of heritage preservation and documentation. The Osservatorio sul Patrimonio Scientifico e Tecnologico of the Museum was created in 2019 also to pursue this aim. A few years earlier we had activated the first research opportunities on the history of the institution[2] (Canadelli 2016) and on the founding collections, which led to the first scientific publications. An initial focus was on the *Raccolta Documentaria dei Primati Scientifici e Tecnici Italiani*, a collection made up of an archive of over 5000 folders and a group of over one hundred related objects, mainly replicas, documenting the national achievements in

1 https://www.sciencemuseumgroup.org.uk/our-work/research-public-history/artefacts-consortium.

2 https://www.museoscienza.org/it/collezioni/progetti/progetto-ricerca-storia-museo.

science and technology, set up by the National Research Council (CNR) in1933 for Italy's participation in the Chicago World's Fair *A Century of Progress* (Paoloni 2018). Another study was dedicated to the collection of interpretative models from the drawings of Leonardo da Vinci created in the first edition for the 1939 exhibition *Mostra di Leonardo da Vinci e delle invenzioni italiane* at Palazzo dell'Arte in Milan and later reproduced for the Museum inauguration in 1953 (Beretta, Canadelli, Giorgione 2019). This publication continues along this path with the collections linked to Guglielmo Marconi, who was one of the principal promoters of the Museum in the 1930s. The roots of the Museum clearly emerge in the political culture of the fascist era, with a strategic project which presents a substantial continuity in the post-war period (Canadelli 2016) and which, also for this reason, needs to be discovered and critically reread.

Studying the collections, therefore, means rebuilding the history of their formation, the provenance of individual objects or groups of objects, the reasons for their acquisition, the actors involved, and the social and symbolic value of the objects within a given historical context (Higgith 2019).

The Museum archive therefore becomes fundamental to the process. It includes inventory registers, the photographic archive, correspondence with donors, internal reports on site visits for possible acquisitions, exhibitions projects, as well as the founder's writings. Often the bibliographical material kept in the Museum library is related to the collections, with catalogues, magazine extracts, dedicated articles in the in-house magazine and other publications concerning individuals and specific topics. From here the research expands to the archives, libraries or museums of other involved parties, not only those in Italy.

Equally important, at the same time, is the philological study of the objects, as they are the primary historical source of the museum. The direct observation of their materiality, the traces of use, the labels and inscriptions present, contribute to understanding the originality, provenance and contexts of use; all the information that it is often not possible to reconstruct using any documentation. In this work it is necessary to consult different fields of expertise: connected to materials, to the specific history of a certain type of object, or as in the most recent historical cases, to the direct testimonies of people involved in various ways in their design, production, and use.

The 'biography' of the objects includes their life before arriving at the museum, as well as their life within the museum, from exhibition to storage or vice versa. It comprehends their preservation, exhibition and documental history, and the various public usages that have been made of them, including the relationship established over time with the generations of visitors. The direct accounts of the different professionals who have cared for the objects within the museum constitute another important source of knowledge (Alberti 2005; 2022).

Making Documentation Practices Public

The documentation of MUST collections began in the early years of the institution's existence, with the creation of object entry forms and the insertion of owned assets or loaned assets in inventory registers, where every object received a unique identification number. Also recorded were the donating party, the year of acquisition, the estimated value and the exhibition or storage space designated to the asset in that moment of history. A label with the assigned inventory number was attached to the object. Simultaneously, the Museum systematically commissioned photographic campaigns of the collections, today preserved in the photographic

archive. Research has still not been carried out to clarify how the internal processes of acquisition and registration of objects were conducted, and which professions were involved, but a preliminary analysis would seem to indicate a stronger link to administrative, rather than historical-scientific, roles.

The transition from inventory to catalogue, that is to say to the historical-scientific documentation of collections, only began from the 1980s and 1990s, in a period subsequent to the establishment, in 1975 of the Ministry of Cultural Heritage and the Central Institute for Cataloguing and Documentation (ICCD), which intended to organise the work on the national catalogue.[3] A journey that lasted more than twenty years, undertaken by universities and museums, in collaboration with the ICCD, it would lead to the creation of a specific cataloguing form for scientific and technological heritage (Miniati 2005-08; Vannozzi 2014; Ferrante 2018). This happened in precisely the same years that this heritage was finally added to the legislation on cultural heritage (Codice Urbani 2004), more than eighty years after the first reports about its neglect (Canadelli, Di Lieto 2024).

Although today there are only a few thousand records for Science and Technology Heritage (Patrimonio Scientifico Tecnologico) published online in the General Catalogue for the Ministry of Cultural Heritage, the PST cataloguing form has now become a reference tool for anyone interested in research activities related to this heritage. Nevertheless, given that this heritage is spread out and fragmented throughout Italy, as in the case of archives[4] and school collections (Morisetti, Servida, Ronzon 2024), it still does not receive the professional attention that it merits.

The most recent history of collection cataloguing at the National Science and Technology Museum engages with this drive to promote research and public interest in Italy's scientific and technological heritage. Essentially lacking a tradition of publishing scientific catalogues for its collections, the Museum has focused on providing free remote access to its documentary resources, firstly by making the catalogues available online: the first 800 object cataloguing records were published in 2007, this then increased to 3,000, followed by the library catalogue in 2010, and then in 2015 the historical archive inventory. Following the COVID pandemic, the digitalization of the Museum collections experienced an extraordinary acceleration on an international level (Baxter et al. 2021; UNESCO 2021) and the Museum also launched a unification and realignment project of the pre-existing data in a new Digital Asset Management System (DAMS), experimenting in 2022 with the publication of all 20,000 objects in Linked Open Data (LOD)[5] format, inspired by the presentation a year earlier of the General Catalogue of Cultural Heritage by the Ministry of Culture. Building on this database, it is planned to integrate the publication of the *collezionionline* interface, and similarly *archivionline* (2023), into the Museum website. This will allow anyone to easily consult all the object records, without any distinction between those with minimal inventory information (even without photos), and those that are more detailed, typical of catalogue record forms, as is already common practice in museums in London and Munich.[6]

This radical choice of broader accessibility seeks to make the internal work on collections increasingly transparent, and it is not without consequences (Getty 2017).

3 https://catalogo.beniculturali.it/.

4 https://archividellascienza.org/it/.

5 https://www.museoscienza.org/it/offerta/linked-open-data.

6 https://collection.sciencemuseumgroup.org.uk/ and https://digital.deutsches-museum.de/de/, respectively.

This is not a matter of a scientific catalogue aimed at experts, the result of a specific collection-based research project which, at a given moment in history, captures the most up-to-date and authoritative compilation of knowledge for the next generations of researchers. What is being made public is essentially the general inventory of the collections, which has been transformed from a back-office instrument to a free access public resource, and which is enriched and updated in step with the documentation and research work that the Museum manages to support. The richness, variety and specificity of the entirety of the Museum heritage thereby materialize, just like the inevitable incompleteness of the information and the qualitative disparity of the descriptions. The layering of cataloguing becomes evident over time which, although created according to procedural norms, reflects the historical and cultural contexts in which it was compiled, and inevitably bears only some of the multiple levels of meaning inherent in every object, depending on who has evaluated it (Cameron 2010, 81, 87).

In this sense, digital technology raises the critical topic of documenting continuous data updates and relevant authorship, as well as conserving the data itself. Ultimately, what is being called into question is the very practice of documentation, which has been transformed from a behind-the-scenes service activity – individual, specialized, single-media, and objectifying – to a public service, becoming one of the tools through which the Museum conveys its values. It acknowledges that objects are examined from multiple perspectives by audiences with varying levels of prior knowledge and personal experiences (Rohde-Enslin 2020).

In reality, digital technologies erode the foundations of the very concept of catalogue, understood as a publication of a collection of individual object records, divided by domain, consultable in a closed system and typical of a traditional paper catalogue. The semantic web brings to light the revolutionary potential of transforming the catalogue from a list of things to a map of relationships, in a system open to technical and conceptual interoperability which allows different domains and systems to connect. The ICCD also embarked on this road in 2018 with the ArCo – Architecture of Knowledge (Carriero et al. 2019) project and other leading science and technology museums are also engaging – as in the case of the London Science Museum (Congruence project; Boon 2022) and the Deutsches Museum (Memory project/Nationale Forschungsdaten Infrastruktur, 2023-28).

From this perspective, it is fundamental for the future to invest not only in technologies, but above all in research and training. The reflection on the value of the catalogue at an epistemological level leads us to question the type of information it contains (Which historiographies? Which disciplinary perspectives? Which narratives?), the relationships that are established (Which connections activate – or do not activate – the chosen data?), and the impact on the public, which is not necessarily aware of the context in which this information is produced. Digital instruments offer the possibility of increasing the range of contributors who interpret or reinterpret the collection objects, conferring on whoever documents these accounts a responsibility similar to that of those who decide which objects to acquire for the Museum collection. It is only by carefully overseeing the process through which this information is gathered and selected, and by choosing to record it transparently, that it becomes possible to comprehend the framework within which it has been interpreted, and thereby open it to new approaches and keep the dialogue between people and collections alive.

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What Makes an Object ‘Real’?

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In March 2024 I met Simona Casonato, Media, ICT & Digital Culture Collection Curator from the Museo Nazionale Scienza e Tecnologia di Milano. She was in Oxford researching the history of our Marconi collection after discovering a duplication between our collections. Simona had spotted that we have identical, or near identical, items which have the same round numbered discs. Simona had travelled to Oxford to see if she could track down any details about the source of these items, thinking that perhaps they were produced by the Marconi company to be used at trade fairs and had been sent around the world (there are reports that a duplicate collection may exist in the Chicago Museum of Science and Industry). One morning we sat at a coffee table in the Weston Library on Broad Street. It is one of the Bodleian libraries, at Oxford University, where the Marconi Archives are preserved: these were collected at the closing of the Marconi factory in Chelmsford, which was the company’s main production site. Simona was there to consult the documents. The History of Science Museum, where I manage the object collections, is just across the road. We discussed the nature of these collections and the consideration that, in the past, the objects selected to preserve Marconi’s legacy were not ‘real’ objects having been produced for show or demonstration.

This led me to wonder what makes an object ‘real’?

The first sentence of the ICOM definition of a museum states that: “A museum is a not-for-profit, permanent institution in the service of society that researches, collects, conserves,

interprets and exhibits tangible and intangible heritage".[1] There is nothing within this on what qualifies an object to be museum worthy. When looking up the definition in the Oxford English Dictionary there are several options which have been used in the past with the definition dating from the seventeenth century being "A building or institution in which objects of historical, scientific, artistic, or cultural interest are preserved and exhibited",[2] although I suspect the definition from the eighteenth century, in extended and derogatory use, of "any large or motley collection of things, esp. outmoded or useless ones; the repository of such a collection"[3] sometimes feels more accurate to many museum collection's staff.

But what makes an object qualify as a 'real' museum object? In this paper I will pose questions to explore the various factors that could be used to make this judgement.

Does Used Equal Real?

A key question with these items is: are replicas or models real objects? Is an item made purely to showcase a concept of equal value to one made to be used? Does an object have to be used to be a valid acquisition for a museum? With the increased focus in museums on contemporary collecting it is not uncommon for museums to buy items directly from the supplier or a shop to ensure that a representative is preserved in their collection. Are these items less valid for still being in their original, unopened packaging? Prototype models are often considered highly desirable items in museums as they show a development of concept, but are generally not made to be used and are often not fully functional as they have been created to show just one aspect of a design. Some of our Marconi items although not used in real world situations may still have been demonstrated at fairs and so may qualify as used. By having this limited use they may be in better condition than those that were extensively used before being donated to a museum.

Does Old Equal Real?

If these Marconi items were donated at the time in which they were created, does the fact that they were new technology make them less appropriate and real as a museum collection item? Does an object have to be over a certain age to be real? The idea of active contemporary collecting of museum objects is a relatively new concept that has come about due to the increased impermanence of items. No longer do our possessions last for decades, are repeatedly repaired and passed down through the generations. If a museum wishes to represent society and its possessions today then it needs to collect them today. A problem contemporary collectors have, much like art curators, is how do you know what items in use today will prove to be meaningful to future museum visitors? These items by being show pieces created by the Marconi Company and used at fairs to

1 ICOM 2022 definition, March 2024, https://icom.museum/en/resources/standards-guidelines/museum-definition.

2 Oxford English Dictionary, s.v. "museum (n.), sense 2.a", March 2024. https://doi.org/10.1093/OED/1145175542.

3 Oxford English Dictionary, s.v. "museum (n.), sense 2.b", March 2024. https://doi.org/10.1093/OED/1034106098.

showcase the developments in the technology that they were at the forefront of creating are excellent examples of what they thought were their significant developments of the time, and over time have proven to be key items to explain the history of the development of this technology. By standing the test of time has this made these objects more real than when they were collected as new technology?

Does Original Equal Real?

Conversely is an item that has replacement parts real? Working items often have consumable parts which have been replaced over time. These items, having been used for demonstration only, will have all original parts. Are they therefore more real than an item that has had many parts replaced? When a museum decides to continue working an item, be that a steam engine in a mill or a car in a transport museum, the decision is made that parts will have to be replaced in order to keep it working. Does this lessen the realness and therefore the significance of that item?

Does Context Equal Real?

When considering items for acquisition, the provenance of that item, who used it, when and where are key questions that I ask of any donor. For me, the story that goes with an item can be more important than the item itself. If an item, such as these, has a clear and complete provenance does that make it more real than one that is simply an anonymous example of a type of object? But, is an object that has no story less real than one that does if it is still has the capacity to remind visitors of their own stories?

I have known industrial and transport museums where objects are still considered tools by some and not really museum items. At a mining museum where ex-miners were volunteers, they saw no difference between the spade they used when a miner, and now an accessioned museum item, and a tool that could be used if they needed to dig a hole. Although a used item, that has a known provenance, due to its age and purpose in the eyes of some this is not considered a real object.

Does Tangible Equal Real?

Increasingly we are looking at the intangible[4] and how we collect it. If something has no physical presence, instead it is an oral history recording or website etc. does this make it less valid, less real, as a museum collection item? Many of

4 The 2003 UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage defines (Art. 2) the intangible heritage as "the practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artefacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognise as part of their cultural heritage. This intangible cultural heritage, transmitted from generation to generation, is constantly recreated by communities and groups in response to their environment, their interaction with nature and their history, and provides them with a sense of identity and continuity, thus promoting respect for cultural diversity and human creativity". https://ich.unesco.org/en/convention.

the problems associated with collecting and preserving this material is the same as it is for a physical item – sourcing it, gaining permission to collect it, how and whether to display it and how to ensure its future preservation. The Marconi collection items are all physical objects does that therefore make them more real than an intangible item in a collection?

Does Uniqueness Equal Real?

Does an item need to be unique to be of value and so collected by a museum? There are multiple sets of these Marconi objects. Are they therefore individually of less value? If something were to happen to our collection would it matter as there is another set in Milan and possibly Chicago, and who knows where else? In the last century, an increasing number of items have been mass-produced and transported around the world to be sold. Does this mean all museums should have a representative example of an item? Or can one or two museums collect an example and then lend it to other museums should they need one? Does it matter if the item collected or displayed was actually used in the collecting area of the museum? Or does the fact that one of this type is likely to have been used sufficient? Which object is more real and relevant to a museum collection?

Does Access Equal Real?

Living history museums often have levels to their collections, where they may have one example that has the best provenance and is in the best condition that is kept within the core collection, additional copies are then kept and used on open display and regularly handled, with their degradation and potential destruction recognised and accepted. The core collection items are accessed less frequently to ensure their preservation. But which object is more real? The one that is used, seen by the public and engaged with? Or the one that stays in the store, safely in a box and is rarely, if ever, seen?

Does Functional Equal Real?

If an item is designed to be used and instead is kept static in a museum, does this make it less real? It is often easier to understand an item when you can see it functioning as it should. However, if an item is no longer in working condition, or the decision is made to maintain it in a static condition, does that make it less valid as an object? Simona told me that one of the Marconi objects in the Milanese collection was opened up to check its interior: there was a key element missing, with no sign that it had ever been present. This means that this example was never built to be functional, merely to show what the outside looked like. Does that make it less or more legitimate as a museum object than something that once functioned and now doesn't? Or something that still functions?

This purpose of this paper is not to determine what should and should not be accepted into museum collections. Or to justify the continued retention, or recommend the disposal, of the Marconi material in either the History of Science Museum in Oxford or the Museo Nazionale Scienza e Tecnologia di Milano. Instead the purpose was to

question the concept of a ‘real’ museum object. To look at what this statement means and if it is possible to define it. From looking at the various ways ‘real’ can be defined it is clear that this is not a concept with validity to define what museums should or should not preserve. Any object that is collected by a museum must be able to justify why it is there, or all museums would soon run out of space to store their collections, but an objects validity within a museum should not be questioned and rejected on the basis that it is not a real object. In fact, in favour of history of science and of our society, should we not instead be thanking the Marconi company for creating ‘museum ready’ items for our collections, and wishing that all technology companies could be as forward thinking?

Marconi & CO. Gli oggetti del Museo raccontano l'altra storia del wireless
A Podcast Series and an Experimental Audio Exhibition

Simona Casonato
Museo Nazionale Scienza e Tecnologia Leonardo da Vinci

Museum anniversaries are often remembered in the most obvious form: an exhibition dedicated to the person or event being celebrated. The 2024 anniversary offered the opportunity to experiment with a hybrid approach, translating the traditional museum format into a podcast.

This format, like all 'new media', has immediately achieved considerable success in the museum sector,[1] as one of the numerous phases in the long process of museums 'mediatization', which has accompanied these institutions since the 1900s. If we indeed observe the history of media technology in this perspective, we cannot forget that museums do not only document and narrate the history of communication, but they always take an active part in it. Well before digitalization, museums have used a variety of media to carry out their work often creatively reinventing uses, languages and devices.[2]

In the case of podcasts, every product developed in the museum context thus reinterprets the relationship between sound discourse and the institution in its own way, focusing on various aspects and possibilities: guided exhibition tours, broadening of the historical

1 Black, H. (2020). "What Makes a Good Museum Podcast?". *In practice, Museum Association*. https://www.museumsassociation.org/museums-journal/in-practice/2020/04/21042020-what-makes-a-good-museum-podcast/. On the podcast phenomenon see Bonini, T.; Perrotta, M. (2023). *Che cos'è un podcast*. Roma: Carocci.

2 Drotner, K.; Dziekan, V.; Parry, R.; Schrøder, K.C. (eds) (2020). *The Routledge Handbook of Museums, Media and Communication*. London; New York: Routledge; Taylor & Francis Group. Griffiths, A. (2008). *Shivers Down Your Spine: Cinema, Museums, and the Immersive View. Film and Culture*. New York: Columbia University Press.

context, biographies of the artefacts, oral histories and interviews, and so on.[3]

This way, the podcast aims to bring the direct encounter with museum collections into the audio dimension, an experience usually entrusted to the sense of sight, and in rare cases, touch. In sum, we experimented with the transformation of the exhibition visit into an aural experience.

The choice was motivated by different reasons.

Since 2020, all the professional sectors operating within MUST have undertaken a collaborative project to reflect on their work practices in relation to the themes of diversity, inclusion, accessibility, and equity. Over the course of 2024 a special opportunity arose to engage in dialogue with a community of visually impaired and blind people. This exchange provided the impetus to discuss the centrality of sight as the main channel to experience the cultural offerings of the museum, and consequently, the historical artefacts and guided tours of the museum exhibitions.

Secondly, the occasion of the anniversary was the stimulus for elaborating new research criteria on the collections linked to Marconi (see Introduction).

So, in 2024 it was premature to rethink the historical exhibition of Marconi relics, with still uncertain research outcomes. The more agile podcast format allowed the addition of another layer of interpretation to the existing exhibition: flexible, ubiquitous, and not limited to physical presence in museum spaces. We felt it to be an appropriate tribute both to mobile communication, a consequence of the invention of wireless technology, and to the radiophonic medium that emerged from it. Interestingly, 2024 marked another national anniversary: 100 years since the first radio transmission by a public broadcaster – the URI, Unione Radiofonica Italiana (Italian Radiophonic Union), which took place on 6 October 1924.

Lastly, the podcast has made it possible to seamlessly integrate and directly present to the public the many voices of academics, and also community representatives, who are advising the Museum on how to reinterpret its own artefacts according to the updated historiographical criteria presented in the volume, linking history and memory. It represents also a special form of museum publication.

The voices that intermingle in the podcast take listeners on a journey through alternative narratives of the historical events that involve Marconi: if we compare these stories to those that have been fixed in the collective imagination by the past interpretation of Marconi relics, they provide more historical detail and context, showing the collective endeavour of wireless communication social construction.

Here is an overview of the project.

3 MUST already had two active podcasts dedicated to the collections: *Gallerie Leonardo da Vinci* (2020), curated by Claudio Giorgione, and *La scoperta del cielo* (2020), curated by Luca Reduzzi.

Marconi & CO. Gli oggetti del Museo raccontano l’altra storia del wireless (2024)

The podcast is available for listening on the most important audio platforms and on the museum website (Italian only): https://www.museoscienza.org/it/podcast/marconi-e-co

Credits

Editorial coordination by Simona Casonato
Texts by Simona Casonato, Roberta Spada, Carlo Annese, Enrico Racca
Audio Editing and Coordination by Giulia Pacchiarini
Editing by Federico Caruso
Production by Carlo Annese
The podcast was created with the support of Regione Lombardia and with the patronage and contribution of Comitato Nazionale Marconi.150.

Episode Summaries

1. “Hills and Oceans: The Man Who Didn’t Invent Radio”

To understand how the story of wireless communication technologies really began, it is useful to broaden our perspective: from the tale of a brilliant boy who invented the radio in the Bolognese hills to the story of a powerful maritime empire, which, even before Marconi and the *Titanic*, considered the safety of oceans around the world.
Gabriele Balbi, Anna Guagnini, Carlo Maisano, Leonardo Merlini, Peppino Ortoleva

2. “Shipowners and Radio Amateurs: How Broadcasting Began”

Radio broadcasting began because of what Marconi defined as a ‘flaw’ in wireless telegraphy. It was difficult to precisely tune two devices: others succeeded in receiving transmissions or accessing naval communications. Many tinkerers took advantage of this flaw to create a new means of communication: the radio.
Gabriele Balbi, Anna Guagnini

3. “Myth & History: The Museum Life of Objects”

Let us discover the legend of Marconi. The story of technological inventions often merges myth and history. But how can we tell the difference between them? Objects and documents from museums and archives help us, but often they too are also products of myths. The important thing is to know how to interpret historical artefacts.
Elena Canadelli, Peppino Ortoleva, Giovanni Paoloni, Paolo Volontè

4. “Scientists and Collaborators: The Alliance that Created Wireless”

Science and technology are collective endeavours. To create wireless technology, Marconi reasoned and acted alongside so many of his peers: people who discovered scientific laws; who built, tested, used and modified devices; who defended them in court; who lauded their innovation, promoting or evaluating them all over the world.
Elizabeth Bruton, Anna Guagnini, Nicolas Maupas, Barbara Valotti, Alessandro Vanelli Coralli

5. “Empires and Colonies: How Marconi Became a Global Enterprise”

To truly understand the story of the Italian-Irish Marconi, it’s necessary to look at the network of companies that bore his name: a true global brand for an *ante litteram* big tech multinational. The Marconi Company was irrevocably linked to the geopolitical aims of its country of origin, Great Britain and its Empire.
Paolo Bory, Marc Raboy, Laura Ronzon

6. “Country & Business: The Scientific Supremacy of Mussolini”

Let us go back to where we started: to Italy, where the business of the Marconi Company was directly overseen by Guglielmo, who returned after the World War Iand found the fascist government to be a valuable ally. As president of the CNR (National Research Council) and the Royal Academy of Italy, Marconi was able to establish his everlasting fame as a worldwide champion of Italian science.
Gabriele Balbi, Riccardo Chiaberge, Simone Natale, Giovanni Paoloni, Marc Raboy

Guests in Alphabetical Order

Gabriele Balbi* USI – Università della Svizzera Italiana a Lugano
Paolo Bory Politecnico di Milano
Elizabeth Bruton University College, Dublin
Elena Canadelli Università degli Studi di Padova, President of Società Italiana di Storia della Scienza
Riccardo Chiaberge cultural journalist, author of *Wireless. Scienza, amori e avventure di Guglielmo Marconi* (Garzanti, 2024, 2nd ed.)
Anna Guagnini* independent scholar
Carlo Maisano Emergency, mission chief Life Support
Nicolas Maupas actor, plays the young Marconi in the fictional mini-series *Marconi – L’uomo che ha connesso il mondo* (Rai 1)
Leonardo Merlini Rear Admiral of Marina Militare Italiana, Director of Museo Tecnico Navale di La Spezia
Simone Natale Università degli Studi di Torino
Peppino Ortoleva scholar of the history and theory of means of communication
Giovanni Paoloni* La Sapienza Università di Roma, member of Accademia Nazionale delle Scienze
Marc Raboy McGill University, Montréal, Canada, author of *Marconi. L’uomo che ha connesso il mondo* (Hoepli, 2024)
Laura Ronzon Collections Director, Museo Nazionale Scienza e Tecnologia Leonardo da Vinci
Barbara Valotti Head of museum activities, Fondazione Guglielmo Marconi
Alessandro Vanelli Coralli Università degli Studi di Bologna
Paolo Volonté Politecnico di Milano, META Coordinator – Unità di studi umanistici e sociali su scienza e tecnologia

* Byrne Bussey Marconi Fellows, Bodleian Libraries, University of Oxford

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Internet Archive
https://archive.org/

Abbreviations

ACS	Archivio Centrale dello Stato
ASMUST	Archivio Storico Museo Nazionale Scienza e Tecnologia Leonardo da Vinci
ATES	Aquila Tubi Elettronici e Semiconduttori
CIM	Compagnia Italiana Marconi
CMND	Civico Museo Navale Didattico (currently Raccolte Storiche del Comune di Milano – Civico Museo Navale Didattico)
CNR	Consiglio Nazionale delle Ricerche
EE	English Electric Company
EIAR	Ente italiano per le audizioni radiofoniche
HSM	History of Science Museum
IRI	Istituto per la Ricostruzione Industriale
MSI	Marconi società industriale
MWTC	Marconi's Wireless Telegraph Company Ltd.
MUST	Museo Nazionale Scienza e Tecnologia Leonardo da Vinci
OBL	Oxford Bodleian Libraries
SIRM	Società Italiana Radio Marittima
STEM	Science, Technology, Engineering, Mathematics
STS	Science and Technology Studies
URI	Unione Radiofonica Italiana
GMSI	Griffin Museum of Science and Industry

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Griffin Museum of Science and Industry, Chicago
History of Science Museum, Oxford
Museo Storico della Comunicazione, Roma
Museo Tecnico Navale, La Spezia

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Simona Casonato

Disclosing Collections

1. *I secoli di Venezia. Dai documenti dell'Archivio di Stato* (2022).
2. Mantoan, Diego (a cura di) (2023). *Tracce d'arte contemporanea a Cortina d'Ampezzo Dall'archivio digitale del Museo Mario Rimoldi*.
3. Minuzzi, Sabrina (a cura di) (2023). *Giardini e virtù medicinali. Salute e bellezza tra passato e presente*.
4. Iezzi, Marco; Pietrangeli, Giovanni (2023). *Dall'Artico a Milano. Il restauro della Tenda rossa al Museo Nazionale Scienza e Tecnologia Leonardo da Vinci*.
5. Casonato, Simona (a cura di) (2024). *Marconi in frammenti. Rileggere le collezioni del Museo Nazionale Scienza e Tecnologia Leonardo da Vinci*.

On the occasion of the 150th anniversary of Guglielmo Marconi's birth, the Museo Nazionale Scienza e Tecnologia Leonardo da Vinci reflects on the historical artefacts and documents collected in Marconi's name. How did this cultural heritage reach us and what does it tell us today about the history of media technology? Marconi was a key figure in the foundation of the Museum, and his Company used the public display of artefacts as a modern communication tool. In this volume, the heritage of the 'Marconi relics' preserved by the Museum becomes the starting point for raising new research questions on Marconi's protagonism not only in the industrial field, but also in the cultural field. Scholars from different disciplines – history of science, media studies, STS, history of industry, art history, museology – turn their gaze to selected elements of the collections to offer alternative perspectives on the canonical celebration of Marconi's biography. The trajectories traced by these stories allow us to explore the cultural context that accompanied the global affirmation of wireless and mobile communication, enriching the ritual narrative around Marconi's name with new actors and lesser-known details.

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MUSEO
NAZIONALE
SCIENZA
E TECNOLOGIA
LEONARDO
DA VINCI