

## SCIENCE ON STAGE: AMUSING PHYSICS AND SCIENTIFIC WONDER AT THE NINETEENTH-CENTURY FRENCH THEATRE

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In the 1860s, Henri Robin's theatre on the then-infamous Boulevard du Temple in Paris presented magic shows featuring ghostly visions from the beyond, and it also held one of the city's allegedly most complete cabinets of physics. On Robin's stage, the supernatural, the magical, and the scientific merged with one another to form a unique performance. Every evening at eight o'clock, the showman, or physicist as he preferred to call himself, entertained his audience with an act in which ghosts of the dead interacted with the living through a play of mirrors and optical illusions. This incredible performance was then followed by demonstrations of mechanical and electrical effects or shows on geology, archaeology, and various sorts of natural phenomena. Robin had a name for this type of entertainment: he called it scientific theatre.<sup>1</sup>

His establishment was not the only one in the capital at the time proposing magic shows that combined tricks and illusions with scientific learning. Since the 1840s, the renowned Théâtre-Robert-Houdin had featured shows of recreational physics and white magic where the public could witness a young boy levitating, spirits of the dead seemingly communicating with the audience, and basic physical experiments and chemical wonders, all in a single night. Some of the most accomplished magicians of the period had performed on its stage. Often calling themselves professors of amusing physics or professors of abstract sciences, these nineteenth-century conjurers continually shaped and reshaped the meanings of science and magic, stretching their boundaries to the needs of their presentations. By the second half of the nineteenth century, scientific learning and technological developments were being moulded and incorporated into the world of conjuring where they were given an aura of mystery and wonder for the amusement of the crowd. At the hands of the magicians, the popularization of science was entering the magic shows.<sup>2</sup>

Ambiguous boundaries between science and magic were not a novelty of the nineteenth-century magic shows. In his work on Parisian fairs a century earlier, the historian Robert Isherwood has argued that there was no clear distinction between science and magic in the popular mentality of the eighteenth century; that the crowds were equally fascinated by mechanical wizardry, magic lanterns, electrical healing, funambulism, fireworks, aerostatics, and phantasmagoria without much thought for what was white or black magic, technological developments, or tricks. Isherwood has successfully depicted the world of the eighteenth-century fairs and popular entertainment in all that it held of the mysterious and the marvellous for the public.<sup>3</sup> Here, I suggest that this sense of wonder did not disappear in the following decades; that,

on the contrary, the concepts of magic and science remained fluid for most Parisians throughout the nineteenth century; and that, at least as far as the marvellous is concerned, the nineteenth century had much more in common with the eighteenth century than is usually assumed by historians. After all, the latest inventions could easily be understood as moving science closer to the realm of the perceived magical and occult. Ballooning, telegraphy, and photography, for example, brought about improvements that would have appeared impossible to previous generations. If it was now accepted that one could travel the air, why not travel to the moon or to Mars? If it had become possible to communicate over long distances, why not consider the possibility of contact across time, or death even? If one could capture the exact image of a living being on a photographic plate, why not that of a spirit? In a world in which news of technological development and scientific discoveries were as eagerly welcomed by the reading public as discussions of séances and haunted houses, the categories of science, magic and the occult remained tangled together, permeable and changing.

Nineteenth-century popularizers of science (and sometimes scientists themselves) encouraged this particular outlook, often ascribing a wondrous character to the latest scientific and technological developments. Louis Figuier, a former professor at the *École de Pharmacie* of Paris turned successful popularizer, for example, used such titles as “*Les merveilles de la science*” and “*Les mystères de la science*”, while Camille Flammarion, noted popular astronomer and writer of over eighty books on subjects ranging from meteorology to the extraterrestrial life debate, wrote on “*Les curiosités de la science*”. Both authors created popular works of science that mingled natural with supernatural, mundane with marvellous.<sup>4</sup> Books such as these were intended to stimulate the imagination of the reading public. They fuelled a sense of awe and nurtured amazement. If popularizers depicted the latest scientific innovations and discoveries as mysterious and marvellous, magicians went further still: they built entire shows on ambiguous presentations of science and magic. They blurred boundaries, talking of wonderful chemistry, recreational mathematics, and amusing physics at the same time as thought-transference and communication with spirits. Using scientific principles, mechanical constructions, and optical devices, they performed acts that seemingly contradicted natural laws. On their stage the distinction between illusion and delusion was seldom made explicit to the public. In order to amuse and entertain, magicians chose to use ambiguity and elusiveness, constantly oscillating between trickery and revelation, mystery and disclosure.

This article explores the junction between popular physics and magic in nineteenth-century Paris. It argues that magicians and magic shows formed an important conduit for science throughout this period and follows the influence of magic practices and technologies in a variety of areas. Magicians exploited scientific content and technological developments to create illusions and provoke a sense of wonder first in their own performances and later on as set designers for the theatre and creators of special effects for the early cinema. In their hands, science took on many meanings and served various purposes: it was the technical knowledge necessary to create illusions on the

stage, a set of pleasant facts and demonstrations in various acts of amusing physics, and a way to separate conjuring from mediumship and spiritism (spiritualism in Britain and America) in order to gain a better standing within a scientifically-minded society. The article is divided into two sections. The first section situates the magic show in the much larger context of nineteenth-century theatre and scientific entertainment. The second section explores the ways in which magicians appealed to and used scientific and technological knowledge in their performances as well as in their contributions to set design at the theatre and later on special effects in early films. Finally, the article concludes with a discussion on the place of nineteenth-century magic shows the emergence of modernity.

#### MAGIC SHOWS AND SCIENTIFIC ENTERTAINMENT IN NINETEENTH-CENTURY PARIS

Nineteenth-century magic shows were the direct descendants of the street fairs of previous centuries. Part of the city's energy and effervescence, the fairs had long been places where all forms of entertainment could be found: acrobats, puppeteers, animal exhibits, plays, cabinets of physics, and, of course, magic shows. By the end of the eighteenth century, censorship in the arts at the sanctioned institutions — the Académie Royale de la Musique (later on the Opéra), the Comédie-française, and the Comédie-italienne — had come to tire the Parisian public. In contrast, the theatre of the fairs, which had never been under the control of the crown, continually provided innovative and dynamic performances for all to see and experience. By then, many theatre troupes, street magicians, and other entertainers had begun to leave the streets to establish themselves more permanently on the Boulevard du Temple situated on the right bank of the city. Over the next few decades, this particular boulevard would become the quintessential site of Parisian entertainment, maintaining its position through the numerous political changes that shook the capital and the entire country. By mid-nineteenth century, in large part because of the theatres housed on it, the Boulevard du Temple had come to be seen by the ruling authorities as an important site of crowd mobilization and a potentially defiant sector of Paris. Thus, under the vast project to improve and embellish the city ordered by the Emperor Napoleon III and completed by the prefect Georges-Eugène Haussmann, it was significantly altered and reduced to four hundred metres in length. From one boulevard to many, however, private showplaces continued to open their doors and flourish on other boulevards of the neighbourhood. By the 1880s and 1890s, as many as half-a-million Parisians were attending plays every week. The age of the theatre had begun.<sup>5</sup>

Throughout the century, it is not just theatres that opened on the boulevards of the right bank. Saint-Martin, Bonne Nouvelle, Poissonnière, and des Italiens — the boulevards of Paris became crowded with wax museums, lecture halls, and magic theatres. Amid all of this effervescence, magic shows offered one set of performances amongst many that were designed to entertain and mislead the senses through techniques of illusions. In fact, during those decades, the city was filled with optical inventions of various kinds: the panorama and the diorama (shows in which large paintings were used to induce illusions in the audience) and demonstrations of magic

lanterns, for example, captured the imagination of the public through optical mechanisms.<sup>6</sup> Outside the theatres and various sites of entertainment, illusions, particularly those of the optical kind, had come to hold some fascination as topics of research. For the new discipline of psychology, they were seen as important clues to the workings of perception and the relationship between the senses and the mind.<sup>7</sup> On stage, they were used to deceive the senses and provoke new sensations and visual experiences in the audience. In most establishments, illusions were meant not to misrepresent the nature of reality but rather to induce awe at all of the possibilities brought about by the latest scientific and technological developments.<sup>8</sup> Magic shows however, were different. There, wonder always went beyond that experienced when faced with scientific and technological prowess, and magicians often insinuated that occult forces could be at play in their acts.

This appeal to occult forces must have sounded very familiar to any audience of the period. By the second half of the nineteenth century, France and the rest of Europe were in the mist of an occultist revival encompassing a number of spiritual and mystical traditions including divination, sorcery, and necromancy. In the 1850s, the Christian socialist Alphonse-Louis Constant had begun to write books on the tarot and magic under the pseudonym Éliphas Levi. In his writings, he attempted to fuse various traditions of the occult into a new doctrine he called occultism. By the end of the century, the term had gained some popularity, and the public had become increasingly interested in stories of black magic and alleged satanic practices depicted in the popular press.<sup>9</sup> Magicians used the incredible claims of the occultists and other movements to their advantage and presented acts reminiscent of some of the supernatural phenomena discussed in the press at the time, and there were a lot. In fact, the second half of the century was filled with extraordinary manifestations and mystical characters: while more extreme manifestations of religious faith seemed to thrive in the countryside where cases of stigmata, possession, and Marian apparitions were reported, in the cities, somnambulists and mediums were fascinating public and scientists alike.

Since the early 1850s, the French were familiar with the *séances* and spiritualism imported from America. Mediums, the men and mostly women who allowed participants at a *séance* to communicate with the other world, could provoke various phenomena ranging from written or oral communication from a particular spirit to levitation, thought-transference, or objects moving at a distance. Ghosts of the dead sometimes appeared at a *séance*. At other times, ectoplasm — spirit matter — could be seen emanating from a medium. For magicians, spiritism and occultism provided a range of spectacular phenomena to exploit and reproduce for the pleasure of their audience.<sup>10</sup>

If claims from the occult world inspired the modern magic show, so did those from the scientific one as magicians tried to incorporate news of sensational discoveries into their performances. Robert-Houdin's act entitled the "ethereal suspension", for example, was inspired by the period's latest medical innovations in anaesthesia. Magicians presented "scientific experiments", or demonstrations of curious and pleasant

effects of science. As such, they were part of the growing numbers of popularizers and showmen performing science on the stages of the cities. The nineteenth century, and particularly its second half, witnessed a tremendous expansion of the market for popular science. Museums, exhibitions, zoos, gardens, and lecture halls emerged as opportunities for those interested in learning about the more recent scientific and technological developments. Competing with other sites of entertainment for the attention of the public, scientific attractions and spectacles became important parts of cities like London or Paris. In the last few decades and predominantly in the British context, historians of science have begun to broaden their scope of research to include such spaces and the people who inhabited them. More recently, there have been studies on the circulation of knowledge and its impact on and implications for the knowledge-making process. Particularly, James Secord has brought attention to the importance of the study of communication for historians of science, of the how and the why of knowledge circulation. In this context, scientific performances and spectacles of all kinds take on their full historical significance. Bernard Lightman has written on the Victorian popularizers who promoted a “sensational science” and has argued for their importance and the need for historians to look at their interpretations of scientific ideas as essential in understanding how the British understood science during this period. In France as in Britain at the time, the spectrum of scientific entertainment was broad, ranging from the more serious attempts to demonstrate scientific principles in public lectures to the purest forms of entertainment meant to amuse an audience; from those popularizers focusing on initiating their audience to the wonders of a particular subfield of science to showmen using science as a vehicle to create illusions and a sense magic, like conjurers.<sup>11</sup>

All of this was not new. Already a century earlier, the professor of experimental physics Jean-Antoine Nollet, for example, had turned scientific learning into an élite form of public entertainment. Starting in 1735, he had given Parisians a taste for electricity with his courses open to the public. Entertaining his audience by transmitting an electric shock through groups holding hands, he had rendered science a fashionable amusement in the capital. Nollet had not been simply a presenter of science: he had constructed and sold his own scientific instruments and received numerous scientific distinctions and titles. In 1739, he had become a member of the prestigious Académie des Sciences, and, in 1753, had obtained the post of Professor of Experimental Physics at the Collège de Navarre, a position explicitly created for him by the king as a post dedicated to making experimental physics accessible to all. Through his various lectures, Nollet had taught and inspired a generation of future scientists, including the future chemist Antoine Lavoisier and future physicist Charles-Augustin Coulomb. His accomplishments and titles indicate the extent of the fluidity which existed between the statuses of scientist and popularizer during the eighteenth century.<sup>12</sup>

Nollet represented but one type of showman of science during the eighteenth century. The professors of amusing physics situated on or near the Boulevard du Temple catered to a more popular audience and focused more on the entertaining aspect of

their performance than on its scientific or educational content. The professor Perrin, for example, performed his brand of amusing physics with a dog that could supposedly read French and English as well as calculate and perform physical tricks. While these types of scientific spectacles were gaining popularity in France, conjuring was developing in new directions with shows now incorporating new acts of amusing physics. Magicians, or professors of amusing physics, were now performing pleasant and amusing scientific demonstrations alongside their usual magic acts. The magician Pinetti, for example, performed shows of experimental physics and called himself a professor of mathematics and physics.<sup>13</sup> In their shows, magicians like Pinetti now presented “scientific experiments” similar to those found in the numerous books of *amusing physics* and *marvellous chemistry* published at the time.

If amusing physics had been added to the magic shows only during the second half of the eighteenth century, it dated back to early times. Both recreational physics and mathematics, in fact, had been popular forms of entertainment at the fairs and the French court since the sixteenth century.<sup>14</sup> Throughout the eighteenth century, a number of pleasant demonstrations of physics and mathematics were explained alongside magical tricks in a few books, for example, in Jacques Ozanam’s *Récréations physiques et mathématiques*. According to Gilles Chabaud, if the appearance of magic tricks in books dedicated to popular science seems surprising to us, it was not for a century in which readers expected dazzling and incomprehensible effects from both science and magic.<sup>15</sup> The same could be said of the nineteenth century when the number of books written on amusing physics, wonderful chemistry, or recreational mathematics exploded. In fact, it is between 1830 and 1910 that the greater number of works on the topic were published, many of them by magicians, and some going through a few editions. In them, the performances described became more complex and began to require some of the various experimental instruments sold in magic shops across the city.<sup>16</sup>

Most books of amusing physics focused more on entertainment. For example, in *L’escamoteur de bonne société ou recueil de tours les plus récréatifs de physique, chimie et fantasmagorie augmentée des expériences les plus nouvelles*, the reader could learn how to get an egg inside a bottle without breaking it. The trick was simple: by immersing an egg into vinegar for twenty-four hours, one could get the shell to soften enough to fit through the neck of a bottle. The bottle would then be filled with water forcing the egg to regain its solidity so as to surprise those who were not familiar with the reaction.<sup>17</sup> Like many other works of its kind, *L’escamoteur* did not offer many learning opportunities for its readers. Its focus was on showing them how to organize an enjoyable performance for family and friends through the use of basic scientific notions. Other books of amusing physics featured simple and exciting experiments of physics and chemistry in order to help the reader develop an understanding of certain scientific concepts such as equilibrium, inertia, heat, electricity, and magnetism. Although most magicians favoured amusement over education, there were some exceptions. G. B. Savigny’s *Les amusements de la science*, for example, contained a letter by the famous magician Dicksonn explaining

to the reader that this particular work would provide them with real information on each practical experiment presented. Unlike other books of its kind in which limited descriptions accompanied tricks and few explanations were given, this one offered analyses and clear instructions on how to succeed in recreating each experiment for its reader. More than simple entertainment, the magician stated, *Les amusements de la science* was intended to teach its reader about various scientific concepts while keeping them entertained.<sup>18</sup>

Magicians like Dickson understood themselves to be part of a much larger movement intended to bring science to the larger public. By the second half of the nineteenth century — with the public craze for scientific inventions and discoveries and with scientists themselves adopting the language of wonder to describe new inventions — recreational physics became a full part of the magic shows. In the journals addressed to professional and amateur magicians at the time, rules of conduct for producing the desired effect in an audience were given and problems associated with this very special profession were discussed. The connections magicians tried to make between scientists and themselves are evident, starting with their self-given title as professors of amusing physics or professors of abstract sciences all the way to the presentation and content of their shows: “Without wishing to push our investigation further into the domain of the theatre”, a writer in one of the trade journals of the time claimed, “we wish to emphasize that conjurers were the first to popularize the sciences.... Since then, they have shown the public applications of wireless telegraphy, x-rays, liquid air (magical kettle), etc.”<sup>19</sup> In the eyes of the magicians, however, popularizing science did not necessarily mean explaining or demonstrating it. They clearly shared in a very flexible and broad definition of popular science, one that included using the various possibilities offered by inventions and research to produce amusing and mysterious performances filled with the vocabulary and imagery of science.

Magicians and others around them even described their shows and theatres as scientific. The famous magician Eugène Robert-Houdin was said to perform acts of “physics, magic, prestidigitation, and instructive and amusing sciences”.<sup>20</sup> Henri Robin described his performances as ones in which physics, magic, and optics combined with mechanics, illusions, and apparitions. In his cabinet of physics, he offered private or public séances of amusing and experimental physics, demonstrations of his photo-electric microscope, as well as representations in geology, astronomy, archaeology, travels, and the wonders of nature using his agioscope, which reproduced specific stories in forty-five frames.<sup>21</sup> On the walls of his theatre were representations of those men who had inspired him. There, the portraits of Archimedes, Galileo Galilei, Isaac Newton, and Georges Cuvier stood alongside those of Nicholas Flamel, Alessandro Cagliostro, and Franz Anton Mesmer.<sup>22</sup> In his almanac, Robin presented his theatre as one in which the public could learn the secrets of science while enjoying itself. In this, he made clear that he believed he had something to contribute to beyond the stage of his theatre: “If I have decided to reveal the secrets of a few experiments, it is first and foremost with the objective to be pleasing to those who take pleasure in

this kind of amusement, and also in the hope to be useful to the inventors that occupy themselves with science and who will maybe find in these secrets many that will be applicable to the arts and the industry”, wrote the showman who clearly prided himself on being more than a simple conjurer.<sup>23</sup>

#### MECHANICS, OPTICS, AND THEATRICAL ILLUSIONS

During the nineteenth century, conjuring came to be seen as an art form, a respectable trade of which illusion and trickery were the product. In the fresh setting of the boulevards, magicians performed, at least in part, for a wealthier audience and adopted a novel, more bourgeois, style of magic.<sup>24</sup> They traded the traditional and extravagant mediaeval attires of the past for the more fashionable and elegant black suits of the industrial age. Increasingly, they presented themselves as men of science: new magicians for a new, scientific era. Few magicians illustrate this trend better than Jean-Eugène Robert-Houdin. When, in 1845, he opened his first theatre in a central location of the city, the Palais-Royal (the theatre was later relocated to the Boulevard des Italiens), he is said to have inaugurated the new era of modern magic, described as a combination of traditional feats of dexterity mixed with dazzling imitations of the latest mesmeric and spiritualist phenomena, sets of surprising experiments in natural magic and amusing physics, and the presentation of complex automata built especially for the magic stage.<sup>25</sup> With his fascination with all that was scientific and technological, his promotion of strict and detailed rules of conduct for a successful magic show, and his interest in the supernatural drama, Robert-Houdin personified this era in which magicians presented their magic as mostly entertaining but also educational. On stage, the wishful scientist accompanied the usual feats of dexterity with his own “scientific experiments”, the inspiration for which was both of the supernatural and natural kinds. His stage was simple and sober with limited furnishings and embellishments. He, himself, always wore a black suit. The aim was to trade one sensationalism for another, from a magic that was marvellous because it was mysterious and unknown to a magic that produced marvels through illusions and kept the mystery that came from creating wonders from the known.

Like many magicians of this period, Robert-Houdin saw himself and was described by others as both a man of the stage and a gifted inventor.<sup>26</sup> Originally from a family of clock- and watchmakers, he had always been fascinated by mechanical and optical devices. Through his marriage with the daughter of a successful clock-maker living in Paris and specializing in astronomical and precision instruments, he was able to move to the capital where he pursued his interests in mechanics and optics and developed a new passion for magic, instruments of amusing physics, and automata. In public libraries, he read up on any topics that might help him with his pursuits and inventions. In the early 1840s, he discovered Jacques de Vaucanson’s century-old flute player and duck automata and built up the confidence to create his own more ambitious mechanical wonders, of which the little pastry maker, the two clowns, and the mysterious orange tree became the most famous. Each of his creations, whether it had a real practical application or was intended for the stage, was meant to stimu-

late the imagination and produce a sense of wonder in its viewer. All this work was not without some recognition. In 1844, Robert-Houdin participated in the universal exhibition held in Paris. There, he presented all of his mechanical pieces to date, including some of his early automata, and obtained a prize.<sup>27</sup>

In July 1845, the watchmaker decided to abandon his father-in-law's shop to try his hand at professional magic. By then, he had had a strong interest in conjuring for many years. He rented a space at the Palais-Royal where he embarked on his nightly performances. The show rapidly became a success. A few of the acts seem to have been particularly popular: among them, the bottomless bottle from which brandy (then beer on his trip to England later on) never ceased to flow; but it was his experiment in second sight, which he performed with his son, that earned him such a great notoriety that, in November 1846, he was invited to perform in front of the Royal family at the Palace at Saint-Cloud.<sup>28</sup> Following the 1848 revolution and the turmoil it brought to the city, the magician, like many other entertainers, decided to move his act across the Channel. He performed, at first in French for the London aristocracy and even the Queen herself at Buckingham Palace, and later on for the workers of Manchester and Liverpool and later still across Scotland and Ireland. As the autumn of 1849 brought back some stability to France and performers gradually returned to their home country, he soon followed.<sup>29</sup>

By the early 1850s Robert-Houdin had become by far the most famous magician in France. In 1852, at the height of his fame, he sold his theatre to his new son-in-law, the magician Hamilton. He moved to a property in his native Blois in order to concentrate on his new passion: electricity. Rapidly, his house became as famous as its owner as it was said to be filled with numerous and amazing inventions. In his retirement, the magician had continued to fill his life with the magic of illusions and inventions. His house was in his image, full of mechanical, optical, and electric gadgets developed to invoke wonder in his staff and his guests. From the electrical landlord welcoming visitors to the automated system to feed the horses, the house was equipped with all sorts of mysterious innovations that served both a useful and a theatrical purpose.<sup>30</sup> In 1855, Robert-Houdin participated once more in the universal exhibition and presented some electrical applications for mechanical instruments for which he again won a prize.

The magician's retirement was not a tranquil one. In 1856, he was called upon by the French government to travel to Algeria, then a French colony, to perform his spectacular feats for the population. He was summoned there to convince the inhabitants of the colony that the science of France was more impressive than the magic of their wizards, who, according to the French government, were often responsible for encouraging the population to rise up. Performing in Alger and later on across the country, Robert-Houdin took his mission as scientific ambassador very seriously. As far as he and the French were concerned, his mission was a success. Back home, he continued with his commitment to scientific wonder and illusions. During the 1860s, he developed optical instruments and presented some of his findings on vision to an optical society in the hopes of getting the members to use some of his inventions.

He died in Blois in 1871. Today, his name is all but forgotten by the larger public (although he is still well-known in conjuring circles and given a prominent place at the Museum of Magic in Paris), but through his presentation of conjuring and illusions and his conception of science and magic as malleable categories, he embodied this second half of the nineteenth century and the golden age of magic.<sup>31</sup>

Like Robert-Houdin, many magicians of this period came to the trade with backgrounds in artisanry, and inventors were ample in the profession. They saw themselves as part of a century of science and were proud of their contribution to the advancements of knowledge. The magician from Toulouse, Marius Cazeneuve, for example, could claim to have a number of inventions to his name including a calendar, a calculator, and an astrolabe.<sup>32</sup> Like many other magicians and popular scientists at the time, he was an autodidact who advertised that he had studied mathematics, physics, chemistry, medicine, mechanics, astronomy, and the occult sciences independently. He called himself *Professeur de Sciences Abstraites*, even outside the theatre. Under this title, he travelled the world. In Madagascar during the tumultuous period of the 1880s, he is even said to have forged a friendship with the queen of the island and have become her confidant and personal physician.<sup>33</sup>

Many of the inventions developed by magicians could be purchased through the few magic shops found throughout the city. Magicians like C. De Vere owned such shops where they made and sold their own material. Magic lanterns, electrical and mechanical tables, puppets, and various apparatuses of amusing physics or illusions were all available for purchase. At *Le Rire Parisien*, a store where magicians and mediums alike could purchase material for their stage performances or séances, one could obtain a fully functional spiritist cabinet, which allowed its user to produce various supernatural phenomena, for five hundred francs. The catalogue of the store contained more than one hundred and fifty pages in which numerous items of magic shows and séances were described. From the coffin in which to be buried alive to the magic ladder, almost any piece of equipment necessary for a magic show or a séance could be purchased there.<sup>34</sup>

By the end of the nineteenth century, advertisements in conjuring magazines reveal that, beyond the world of magic and make-believe, magic shops were now also supplying numerous more generalized theatres of the capital.<sup>35</sup> Magicians were beginning to be asked to create illusions for particular plays.<sup>36</sup> In the world of theatre, optics, electricity, and chemistry had become crucial components of set design and special effects. In his works on set design published in 1873, Georges Moynet argued that the theatre of his time had come to require the help of all of the arts, that beyond the quality of a written play and the work of the actors, the public now demanded good scenery and a set of impressive illusions to go along with it. Fortunately, contemporary theatre now benefited from the resources of science to create illusions on the stage, he wrote.<sup>37</sup> In fact, illusions had become key to the plays. In *Les trucs du théâtre*, Max de Nansouty wrote that "... the theatre has the right and the mission to provide us with illusions".<sup>38</sup> This could be accomplished through carpentry, mechanics, staging and various other techniques and apparatuses.

Whereas set designs and mechanics had been used since the sixteenth century, the mid-nineteenth century can be distinguished by its more thorough use of physics and chemistry as techniques of illusion in the production of plays.<sup>39</sup> In a number of books published at the time, tricks and inventions used on the stage were duly explained, and credit given to those who developed them: the set designers and magicians working across the city in various establishments of amusement. From ways to construct a specific set to basic tricks involving hidden doors and special lighting, as well as more complex phenomena requiring a certain knowledge of chemistry, electricity, optics, acoustics, hydraulics, or mechanics, all the different aspects of set designs and production that might call for the use of scientific and technological developments could be sought out and understood. From the colouration of a liquid to the creation of the impression of dawn or thunder to more spectacular and marvellous effects such as disappearing acts or visions of ghosts, each of the techniques necessary for set design and production could be found in these works, which were intended to provide some explanation of the hidden aspects of the theatre experience, to reveal the tricks behind the wonder.<sup>40</sup>

Technologically, theatres went through several changes throughout the decades. By the end of the nineteenth century, long gone were the candles and the oil lamps, now was the time of gas and electricity. If it did not completely end the risk of fires on the stage, it did significantly reduce it. Controlled by a panel from which an electrician would put on a light show, the new lighting offered a multitude of previously impossible options. As lights could now be lowered before and after the performance and retracted during any or all of the acts, the public could more comfortably enter and exit the room. Projectors could easily be employed to create the effect of daylight, night time, moonlight, and so on.<sup>41</sup> The use of electricity, however, was not limited to lighting. In fact, it was also used to manoeuvre everything from the curtains and the sets to the ventilators and the radiators, significantly reducing the number of mechanics necessary to run a play.<sup>42</sup>

Beyond electricity, theatres had become filled with tricks, both small and large, used to create illusions in ways reminiscent of the magic shows. Mechanics were now expected to create the impression of thunder, lightening, rain, fog, snow, etc. Using various objects, optical devices, and mirrors, they were able to give the appearance of numerous natural phenomena on the stage.<sup>43</sup> Artillery and pyrotechnics had also become important for some plays, so much so that many of the larger theatres had come to employ specialists in the domain. The sounds and the looks of war and fighting had to be reproduced as realistically as possible. Various systems were developed for gun-fighting scenes. One such technique consisted of using a cork filled with powder which was inserted into the gun, for example.<sup>44</sup> Even closer to the world of magic, hidden doors now allowed actors to disappear through walls and ground. It was from these hidden openings that devils and other supernatural creatures would appear during a performance.<sup>45</sup>

Many of the techniques discussed in works on set design had been perfected by magicians. In their book on science at the theatre, Alfred de Vaulabelle and Charles

Hémarquinquer noted the role that practices of the magic shows had come to play in the creation of set design and special effects.<sup>46</sup> Hidden doors, specialized equipment, and mechanical devices were all being used to create a new realism on the stage. Among all of the techniques borrowed from the magic shows, however, it was those involving optical tricks that were probably the most exciting to watch. Mirrors and glasses could be used to produce ghostly apparitions that materialized on the stage and interacted with the actors. They could create the illusion of a severed head simply lying on a table or immersed in a bowl of water as well as countless other spectacular illusions.<sup>47</sup>

All of this had begun much earlier. Dating from the seventeenth century, the magic lantern had allowed its users to project images painted on glass onto a screen. Throughout the eighteenth century, projectionists had been travelling the country and performing for various audiences with such apparatuses. At the end of the century, Etienne-Gaspard Robertson had stunned Parisians by staging, every night at seven in the Cour des Capucines close to the Place Vendôme, his own phantasmagoria. Using a magic lantern, Robertson would frighten his audience by presenting it with a chilling show in which silence was soon replaced by wind, lighting, and ghosts of all sizes flying across the dark room of his theatre. Just as Robin would decades later, Robertson was already combining the natural and the supernatural, since, in order to get to the phantasmagoria, the public first had to go through a cabinet of physics filled with several mirrors and a panorama. There, various experiments were performed for the audience everyday. While Wednesdays and Saturdays were dedicated to hydraulics, Mondays and Fridays were reserved for galvanism. Only once this initial demonstration of the possibilities of science was over would the public be asked to enter the theatre to be frightened by visions of ghosts materializing close to their seats.<sup>48</sup>

Robertson was not the only one to use optics to produce illusions at the time. Cabinets of physics and their optical illusions had been part of the fairs throughout the eighteenth century. During the revolution, mirrors, glasses, lanterns, and shadowgraphy had begun to be used in the theatres of the boulevards. At the same time that Robertson was entertaining his public with a mixture of scientific lessons and phantasmagoria, other performers were also bringing demonstrations and ghostly visions to their audience. The magician Comus (Nicolas-Philippe Ledru), for example, presented his experiments of physics, mathematics, and phantasmagoria on the Boulevard du Temple to great success. Just like Nollet before him, he was even given the title of Maître de Physique des Enfants de France by the king.<sup>49</sup>

The tradition of using optics to create wonder continued throughout the nineteenth century. By the second half of it, magicians had begun to incorporate optical devices in their performances in order to foster illusions. Upon opening his theatre in the 1860s, for example, Robin rapidly gained fame for his dissolving ghosts. Invented in England by John Henry Pepper and appropriated (and perhaps perfected) by the Frenchman when he visited the Royal Polytechnic in 1851 and 1854, the illusion of the dissolving ghost quickly became notorious around the capital.<sup>50</sup> It consisted of a

set of mirrors that allowed actors hidden below the stage to interact with the actors on the stage as ghosts from another world. To strengthen the illusions, the ghosts were dressed in pale clothing and illuminated by lanterns while the actors playing the living were dressed in darker colours without much light on them.<sup>51</sup> Sitting in Robin's theatre, the audience could watch a lover crying and recalling his dead fiancée who suddenly appeared dressed in a shroud that she then lifted to reveal her wedding dress. The lover would then try to touch her but remained unable to grab her while, to his great chagrin, she slowly disappeared again. The effect was stunning and so realistic that women among the public were said to lose consciousness during the show.<sup>52</sup>

It did not take long for theatres of the boulevards to ask assistance from Robin. In 1863, this same illusion was used on the stage of the Théâtre du Châtelet in the play *Le secret de miss Aurore*.<sup>53</sup> This time, however, the trick had to be adapted to a bigger theatre. Robin had performed his act in a room with only a few loges and no gallery. The magician thus had to rework his illusion so that those higher up in the room would not be able to see the actors playing ghosts below the stage.<sup>54</sup> In 1868, Robert-Houdin also organized a similar effect for the play *La Czarine* presented at the Théâtre de l'Ambigu.<sup>55</sup> By this time, mirrors had already been used to decorate theatre stages. Already in the early nineteenth century, giant mirrors had been employed to great effect, mostly because the public had never seen mirrors of such size. Tricks employing mirrors, however, were not presented until the 1860s when magicians began to collaborate with set designers and teach them illusions of the magic shows. Unfortunately, illusions involving mirrors were difficult for set designers to reproduce as mirrors were expensive, fragile, difficult to handle, and hard to put in storage.<sup>56</sup>

Among all of this, the most lasting contribution of the magic shows to the entertainment world took place not in the theatres but in the realm of cinema and special effects. Magicians and their various optical inventions and illusions are often featured prominently in the pre-histories of the cinema, the magic lantern being described as one of the precursors of the camera. With the invention of the cinema, this contribution did not cease but continued as magicians popularized films and developed special effects as new illusions for the screen.<sup>57</sup> In fact, it was the magician Georges Méliès who first introduced the camera to the paying public. In 1888, he had bought the Théâtre-Robert-Houdin where he performed as a magician. A few years later, Louis Lumière showed him a new invention. Méliès understood instantly the possibilities held by the *cinématographe* for his shows and tried to get one from Lumière. When this failed, he decided to build one himself. In 1895, he is said to have opened the first public cinema in the world at his theatre, initially combining stage magic with short films. He brought the techniques of the stage to his early films, many of which consisted of simple reproductions of theatre tricks. In October 1896, he opened the first cinematic studio at Montreuil-sous-Bois, just outside Paris. By 1897, he had invented numerous original illusions especially adapted to the new medium of the screen. In his films, he employed a variety of tricks involving chemistry, pyrotechnics,

photography, theatrical mechanisms, and conjuring. In 1900, he founded the *Chambre Syndicale des Éditeurs Cinématographiques* and continued with his involvement in the development of the novel form of entertainment.<sup>58</sup>

Other magicians also followed him as film pioneers. The Isola brothers, for example, began to organize showings at their magic theatre a few days after Méliès did. Soon, they were making and selling their own projectors, the *Isolagraph*, to others.<sup>59</sup> Many magicians bought such devices and transferred their tricks to the screen. They brought their films with them on tour to be incorporated into their shows. These trick films would eventually lead to the development of the new field of special effects. Disappearances, behavings, transformations, descents into hell, and travels with mermaids all laid the foundations for the future of the film industry.

By the beginning of the twentieth century, however, the cinema was proving to be a deceiving friend for stage magicians. By 1914, there were one hundred and sixty cinemas in Paris while more and more magic theatres were closing.<sup>60</sup> First introduced as an apparatus among others on the stage, the camera had come to supersede the shows it was meant to complement. After all, once the techniques of the film were mastered, anyone could replicate the magic of the conjurers, even surpass it. Some magicians continued to perform on the stage, bringing more emphasis to their skills as conjurers. Others decided to abandon the theatre and join the world of cinema. Just as in the theatre before, those magicians worked on films as creators of tricks and special effects rather than performers. As the public developed a taste for longer, more serious stories, however, the focus came to be more on the actors than the tricks. Cinema was also becoming a big industry with lots of financial interests. Small-time producers and magicians like Méliès and the Isola brothers were finding it impossible to keep up.<sup>61</sup>

If, in 1912, the magician Alber was still able to write that magic was not dead, and more importantly that it was giving life to the cinema, it was becoming increasingly apparent that the days of the spectacular theatres and their stage performances were gone.<sup>62</sup> Most magicians were now performing in travelling shows and vaudevilles among acrobats, athletes, dancers, comedians, and animal trainers.<sup>63</sup> By the beginning of the Great War, the public who for decades had attended the performances with delight had now lost interest in the conjurers and had turned to the magic of the cinema. Nowhere was the deplorable state of the old magic theatres more visible than at the *Théâtre Robert-Houdin*. In 1914, it was destroyed to make way for a new boulevard. Its owner, Georges Méliès did not have the resources sufficient to rebuild his once illustrious theatre. Now penniless, he was forced to take over a small booth in the *Montparnasse* train station selling candies and toys to children until his retirement. Not until the 1930s would he be recognized and celebrated as one of the creators of cinema, the same medium that had brought about an end to his own magic shows.

In his work on popular science in the eighteenth century, the historian Michael Lynn argues that, as an increasing part of the population began to see scientific learning as

worthy of spending their time and money on, science became an object of popularization and a part of urban culture.<sup>64</sup> As it continued to flourish throughout the nineteenth century, magicians joined this new culture. It was a golden age for the magic shows. From the streets and the fairs to the theatres of the boulevards, the magician's trade rose to a respected art form to be enjoyed by many during this period. Through all of this, it was not just magicians and their magic shows that changed, but the city itself. The wide boulevards and their new theatres attracted Parisians and tourists alike at a time when the city was undergoing a major remodelling project. Paris itself was turning into a site of spectacle with all of the characteristic of a modern city, its boulevards occupied by cafés, theatres, museums, panoramas, dioramas, and magic shows. Amidst all of this, magicians provided their audience with a connection between the marvels of the past and those of the new modern city life.<sup>65</sup>

Magicians were part of a culture deeply interested in occult wonders and unknown forces and human abilities. At the same time that magicians were performing on their stage, scientists and believers were attending séances and hoping to uncover evidence of the existence of the soul and an eternal life after death. Spiritism and occultism held the attractive potential to provide spiritual alternatives based on scientific evidence. In a world increasingly secular and at a time when scientism was prevalent, these movements, if marginal in numbers, became prominent in terms of their cultural influence and ramifications. Historians such as Alex Owen have argued that they, in fact, formed an integral part of the development of the modern outlook particularly as regards subjectivity and the self.<sup>66</sup> By reproducing occult and spiritist phenomena in their shows, magicians were part of this broader culture and played on some of the central dilemmas offered by the occultist outlook. Just like the spiritists looking for proof of a supernatural existence to be accepted outside of faith in the physical evidence left at the séance, magicians exploited the seemingly magical character of science to dazzle their audience and presented themselves as modern men entrenched in their era producing illusions rather than magic; but they did so while keeping an ambiguity about their productions, while cultivating a sense of the supernatural. By revealing to us what late nineteenth-century Parisians found entertaining and the ways in which they enjoyed shows in which magic tricks and visions of ghosts were sinuously merged together with scientific demonstrations and pleasant commentaries on physics, magicians provide us with a glimpse of the concerns and interests of their contemporaries and remind us that, for many, late nineteenth-century science continued to hold some magic.

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