

THE EIFFEL TOWER

An Alliance of Two Outcasts

In this diatribe of 1857, the architect Charles Garnier paired two of the great inventions that were change the face of art in the second half of nineteenth century: photography and the use of metal in architecture. Not that he contested their usefulness. He conceded that photography could render services, presaging Baudelaire's remark in his criticism of the 1859 Salon to which photography, previously exhibited alongside the products of industry, was admitted for the first time: "It must return to its true duty, which is to be the servant of the sciences and the arts, but a very humble servant, like printing and stenography, which neither created nor supplanted literature. Let it quickly enrich a traveller's album and give his eyes the precision that his memory seems to lack; let it adorn the naturalist's library, exaggerate microscopic animals. Even fortify the astronomer's knowledge with a few facts; let it be the secretary and notebook for anyone whose occupation demands absolute material exactness, thus far nothing could be better." As for the used of iron in architecture, it is neither useless nor reproachable, as long as it is restricted to the attics and floors of traditional buildings, or to railway stations, hangars, market places, and hothouses..." because Garnier believed that "iron is a means, it will never be a principle".

These viewpoint reflect an opinion widely held in artistic circles which aimed to restrict the scope of metal architecture and photography, then both fledgling disciplines. Without denying the ideological and aesthetic aspect of the debate, it is important not to overlook the rivalry between architect and painters, on the one side, who wished to safeguard their respective fields, and engineers and photographers, on the other, seen as potential rivals.

These division persisted for several decades. By their very nature, engineering works such as bridges and railway lines, increasingly built of metal, were located outside of built-up areas. This fact was compounded by the political wish to relegate industry to the outskirts of the capital which meant that most of the buildings with a metal frame were erected in the suburbs. Wanting to publicise their achievements –since few people went to see them- the engineers used photography which was a faster and better means than painting to present their daring designs and the monumental nature of their buildings. Thus, restrictions on the use of iron and on the field of photography brought the two outcasts together. On side of the divide stood Paris, stone architectural and painting; on the other, the suburbs, metal architecture and photography. This dichotomy came to an end, not without a last outburst of violent polemic, with the construction of the Eiffel Tower, in the heart of Paris, for the World's Fair 1889. It became glaringly obvious that photography was the best means of representing metal architecture.

Objective: a Thousand Feet

The world's fair, 1867, the first held on the Champ de Mars, had marked the height of the second empire. Following defeat in the war with Germany in 1870, the 1878 fair allowed France to take its place once more in the concert of great nations. Republican France in the early 1800s was the most of an economist crisis and chronic political instability. Determined to proclaim its principles all the same, it felt honour-bound to celebrate the first centenary of the revolution with special solemnity and to proclaim all its founding values. The organization of a new world's fair for 1889, seemed both a way to boost the economy, through major building projects, and a opportunity to recreate a political consensus around the centennial celebrations. The project was mooted as early 1880. At the same time, the idea of designing a monument to mark the fair in a spectacular way was born.

For some decades already the race for height had fired the public imagination; many engineers dreamed of exceeding the symbolic bar of 1,000 feet (about 300 metres). Several projects came to nothing: the 1,000-foot open work cast iron column designed by the English engineer [Richard] Trevithick [1773-1833], who died before construction began; nor the iron cylinder of the same height, dreamed up by the American engineers Clarke and Reeves for the 1876 world's fair at Philadelphia, which failed to find founding. In France, in 1883, Jules Bourdais, one of the architects of the Trocadero Palace, working with the engineer Amédée Sébillot, planed to endow Paris with a gigantic masonry and granite lighthouse of five storeys surrounded by galleries and topped with a metal lantern. Emile Nougier and Maurice Koechlin, chief engineers with the Eiffel firm, sketched a large pylon made up of four latticework beams spread at the base and meeting at the top, held together by metal beams at regular intervals. This preliminary project was submitted to Gustave Eiffel who authorised his engineers, without much

enthusiasm, to go on with the project. After some charges made by Stephen Sauvestre, the architect attached to the Eiffel firm, the drawing was chosen for display at the Decorative Arts Exhibition to be held in autumn 1884 at the Palais de l'industrie. That was when Gustave Eiffel change his mind and filed a patent in the name of Eiffel, Nougier and Koechlin. From then on Eiffel threw himself wholeheartedly into improving the project for a 300-metre iron tower for the 1889 exhibition, according to the title of the lecture he gave to the Society of Civil Engineers on 30 march 1885. He added technical details to increase the project's credibility, its cost, estimated at 3,155,000 francs, in fact, increased by a factor of 2.5; its weight, planned to be 6,500 tones finally totalled 7,300; and construction time, estimated at one year, in fact required twenty six months. He still hesitated between iron and steel, but eliminated masonry which he did not believe to be feasible. This judgement was intended to discredit Jules Bourdais, whom he esteemed his most dangerous rival.

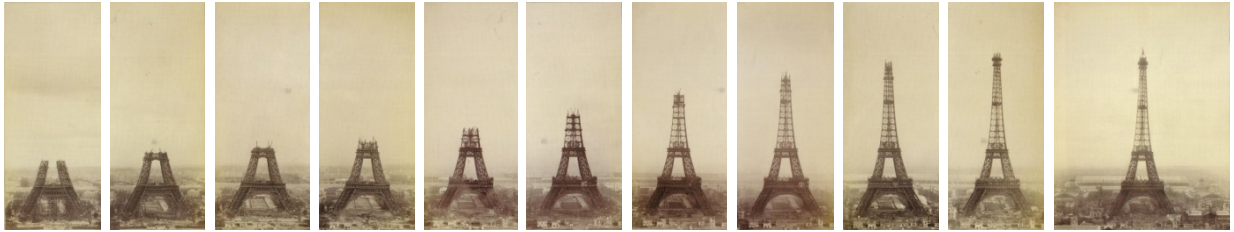
This began to take shape in may 1886. The budget for the exhibition was voted and the programme drawn up more clearly. Édouard Lockroy, the minister of trade, who believed in Eiffel's project, could not openly refuse the project put forward by Bourdais, who was a friend of the chairman of the Council, Freycinet, and well placed in architectural circles. So he decided to hold a competition, the rules of which stipulated that: entrants must study the possibility of raising on the Champ the Mars an iron tower with a square base, measuring 125 metres on each side and 300 metres high. Chaired by Adolphe Alphand, the director of works for the city of Paris, the panel received 107 projects, including one by Bourdais who had switched from granite and iron, and, on 12 June, unanimously chose Gustave Eiffel's project.

Meanwhile, Eiffel had bought sole ownership of the patent from Nougier and Koechlin, agreeing to quote their names and pay each of them 1% of the sums he received. In the became pressing to make a decision about the site the tower. Locations some distance from the exhibition were quickly rejected. A choice had to be made between those who wanted to put it on an elevated site, on Chaillot hill, those who imagined a monument spanning the Seine, and supporters of the Champs de Mars, who finally won the day. An agreement was signed on 8 January 1887 between Édouard Lockroy, representing the French state, Eugène Poubelle, prefect of the Seine, on behalf of Paris, and Gustave Eiffel, on his own account. Eiffel undertook to build the tower and bring it into operation for the opening day of the exhibition. He was to be granted a subsidy of 1,500,000 francs and authorisation to operate the tower throughout the Exhibition. At the end of the exhibition, the state would pass ownership of the monument to the city of Paris; Eiffel would keep the concession for twenty-one years after which the town council would take it over.

Construction, Photographers and Critics

“With a spurt of legitimate satisfaction, on 28 January 1887, I saw an army of earth-movers star work on the great excavations which will hold the base of the four feet of this tower which has been a constant preoccupation for me for over two years.” Several photographers frequented the construction site from the beginning, part of the tradition of photographers of engineers works which goes back to the 1850s, the most famous of whom in France was Édouard Baldus (1813-1889), and the responsible for covering the construction of the new Louvre from 1854 to 1857, and the railway lines from Paris to Boulogne and Marseille.

Louis Émile Durandelle (1839-1917), who worked in partnership with Hyacinthe Delmaet until the latter's death in 1862, continued with Delmaet's widow, Clémence, who so became his wife. Under de company's name of Delmaet and Durandelle. He has photographer the construction of the Paris Opera House by Charles Garnier. From the beginning of 1887 he set to work and made a series of painstakingly dated plates, long views, which show how quickly the tower went up from the foundations his portraits to the finishing touches in March 1889. Pierre Petit (1832-1909), better know for his portraits, was one of the photographers authorised to print the works presented at the World's Fairs in Paris in 1857, 1867 and 1878. He had also covered construction of the Statue of Liberty by Bartholdi, showing the structure designed by Gustave Eiffel, the stamping of the copper sheets, and the statue's temporary assembly in the rue de Chazelles, Paris, before it was dismantled and sent to New York. He was one of the first professional photographers on the site, even before construction began on the vacant lot of the Champs de Mars. Less well known, Theophile Féau (1839-1892), a keen amateur and the inventor of a mechanical shutter, was given official permission to set up a tripod at the top of one of the towers of the Trocadero Palace. From there, without changing his viewpoint, he took a regular series of shots showing the construction of the tower. He printed some in a leaflet rather like a short film on the construction.



The first problem facing Eiffel was that of the foundations. The subsoil on the chosen site, the part of the Champ de Mars that belonged to the city of Paris, enabled the concrete for the rear piles to be poured in the open air. But, for the two piles closer to the Seine, moisture and shifting sandy ground required the use of watertight metal cages and an injection of compressed air so work could be carried out below water level.

Was Gustave Eiffel was working on suitable solutions, opponents of the project kept up their attacks. As soon as the results of the competition were announced, the columns of trade magazines were opened to its detractors. On 26 June 1886, P. Planat's column 'Causerie' in *La construction moderne* headline "La tour-drague" and started: "The Eiffel Tower is my subject today. I have just been to see it, no out of pleasure, but by necessity, since its cumbersome person is forever in the public eye: impossible to open a political, literary or technical journal without coming across a pompous advertisement, with skeleton-sketches, in favor of this semaphore which is supposed to be the 'main attraction' of the future exhibition. Lord, what will the lesser attraction be?". On 14 February 1887, "*Les Temps*" published a petition addressed to Mr. Alphand by a group of artist including Charles Garnier, Guy de Maupassant, Alexandre Dumas fils, Francois Copée, Laconte de Lisle, Victorien Sardou, Sully Prudhomme, Charles Gounod, William Bouguereau and Ernst Meissonier. Probably written at the prompting of the architects of the institute, who were furious to see public commissions escape them, this petition protested in the name of "little known French taste" against the erection in the centre of the capital of "the useless, monstrous Eiffel Tower" which will deface and dishonour the city. "To understand what we mean, just imagine a vertiginously ridiculous tower dominating Paris, like a huge black factory chimney, its barbarous mass crushing Notre Dame, the Saint Chapelle, the Saint Jacques Tower, the Louvre, the dome of Invalides, the Arc de Triomphe, all our monuments will be humbled, all our architecture dwarfed and will disappear in this stupefying dream. And for twenty years we will see spread like an ink blot, throughout the whole city, still trembling from the genius of so many centuries. the odious shadow of the odious column of bolted iron. It is up to you who so love Paris, who have so beautified it, who have so often protected it from administrative destruction and the vandalism of industrial companies, to defend it one more." Édouard Lockroy ironically suggested that Alphand should post the protest in the windows of exhibition: "Such fine and noble prose signed by names known throughout the world could not fail to attack the crowds and ever perhaps astonish them."

Gustave Eiffel defended himself in a interview published in "*Le temps*" on the same day as the petition: "I believe that the tower will have its own beauty. Because we are engineers, do people think that we do not care about the beauty of our constructions and that as well as making them strong and durable we do not try to make them elegant? [...] The tower will be the highest building men have ever raised. Will it not therefore be grandiose in its way? And why should what is admirable in Egypt become hideous and ridiculous in Paris? I have thought about it and I admit I do not understand.

The protest says that the tower will crush with its barbarous mass Notre Dame, the Sainte Chapelle, the Saint Jacques Tower, the Louvre, the dome of the Invalides, the Arc de Triomphe, all our monuments. So many things at one! really, what a joke! when you want to see Notre Dame, you go and stand on the square in front of it. How could the tower, on the Champs de Mars, bother someone standing on the square in front of Notre Dame, where he cannot even see it? Besides, it is one of the most mistaken notions, although widely held, even by artist, that a tall edifice will crush the surrounding building."

A Gigantic Meccano

On 1 July 1887 assembly work began once the massive masonry foundations were finished, the hardest part was building the diagonal pillars assembly them with the horizontal beams of the first level. The lower parts of the piles were raised with gins fitted with hoisting gear. The gins were made up of long pieces of wood tied together at the top, in the shape of an A. The

principle was simple: a winch at the bottom, and a pulley at the top to roll the chain attached to the winch holding the piece to be lifted. Eiffel had foreseen everything, two of the piles were mounted on a hydraulic jack, so their inclines could be adjusted at the last moment. He also put sand boxes between the horizontal beams and the scaffolding which supported them; by gradually emptying the sand the position of diagonal and horizontal pieces could be finely adjusted. The parts were lifted to a height of thirty metres without scaffolding by means of twelve-ton pivoting cranes using the runners later to be used for the lifts and going higher as the pillars rose. The twelve temporary wooden scaffolds shore up the pillars, the other 45 metres high were needed to hold the 70-tonne girders on the first platform. On 7 December when the pieces were successfully assembled, Eiffel knew that he had won his bet.

After that construction was easier. The scaffolding was replaced by small wooden platforms around each edge. The first platform, 57 metres above the ground, then the second platform, at 117 metres, were successively used to haul materials up to the construction site. Past the second floor, nothing more was needed than the two cranes which used the runners of the future lifts.

Durandelle's almost exclusive interest in forms in his photographs mean few people were portrayed, but also reflects the way Eiffel organised the site. Much of the work was done in the company's workshops at Lavallois-Perret. The pieces were designed and cut out in the workshops and arrived on the site partially assembled. If defects were detected, they were sent back to the factory but were never repaired in site. The 18,000 pieces making up the Tower required 7,000 drawings and 3,500 working drawings, which kept draughtsmen and calculators busy for two years. The workers in the factory where two-thirds of the 2.5 million rivets were fitted numbered 150. On site, the main task was assembling the pieces like a gigantic Meccano set. The men worked in teams of four: the first heated a rivet in a small forge, the second inserted in the hole and held it in place while the third hammered the other side and finally the fourth flattened the head with a sledgehammer.

In September 1888, the tower rose beyond the second platform. Considering that the work was getting more and more dangerous and annoyed to see their income drop because of shorter work hours in winter - twelve hours a day summer, only nine in winter - the workers demanded a raise. After a two-day strike an agreement was reached. Tension rose again in December, but Eiffel threatened to consider that workers who did not go back on the job had resigned. He was deaf to the claim that the risk rose with the height of the site and indeed there was only one fatal accident in twenty-six months.

On average there were 200 workers rising to 250 at peak times, and they can be seen on photographs taken by Henri Rivière (1864-1951). Better known for his engravings and drawings, Rivière was a practicing photographer from the mid-1880s until probably just before World War I. His photographs of the Tower, taken just before completion, are much smaller than those of Durandelle or Petit. He took snapshots, close-ups and high and low-angle shots. Rivière did not use the instant camera with flexible film marketed by Kodak in 1888, but a wooden camera with bellows, a frame and plates, which was nevertheless light and portable. In this viewfinder, the workers became acrobats, agile mountaineers, who turn to pose for the camera. Rivière worked at the Chat Noir theatre, and photographed members of the troupe who came to visit the Tower a few days before its completion. But, as much as the men working on it, his eye caught by the beauty of the monument itself, its architecture, and the spatial and visual surprise it had in store. When some thirty of Rivière's photographs were given to the Musée d'Orsay in the Eiffel papers in 1981, they were not immediately attributed to him though it was clear that the engraver had seen them before embarking on *Trente-six vues de la Tour*, a work with a Japanese flavor that pays tribute to Hokusai's *Thirty-six Views of Mount Fuji*. It was only five years later, when Rivière's heirs gave the museum about fifty new photographs known to be by him, several of which were identical to those already in the Eiffel collection, that they were attributed to Rivière.

Popular Acclaim for the Tower at the 1889 Exhibition

The Tower was completed on 31 March 1889. Surrounded by a few brave people who had climbed up with him, Eiffel ceremonially hoisted the flag on the top of the lightning conductor. The other guests waited lower down. And for good reason: the lifts were not yet in operation and did not begin to run until a week after the opening of the Exhibition on 15 May, so they had to climb the steps to the third platform! To reach the first platform it was necessary to climb 387 steps, 674 to the second, 1,130 to the third, finishing with a ladder, 1,710 to the summit. It took about thirty minutes to climb up to the third platform. A twenty-one gun salute was fired when the flag appeared.

“When the gates opened, when the crowd could at last touch the monster, stare at it all around, walk between its piers and climb on its flanks, the last resistance fell even among the most recalcitrant”, wrote Eugène Melchior, adding: “perhaps, rather than crushing the Exhibition, as people predicted, the triumphal gate would frame all its prospects without hiding anything”. The photos taken by the Neurdein brothers and widely circulated confirmed this appreciation. Famous for the boost they gave postcards and for obtaining the right to use the photograph collection of the Historical Monuments Department between 1898 and the outbreak of World War I, Étienne (1832-after 1916) and Louis Antonin (1846-after 1916) Neurdein had recorded the construction of the Tower. But they continued their work bringing the monument to life by showing it in its environment during the World’s Fair. Under the brands “ND Phot” and “X Phot”, they published souvenir albums that remained popular well into the first decades of the twentieth century. Their photographs show visitors on the walkways and crowding into the lifts; the Tower is shown alongside its successive short-lived neighbours, the Machine Gallery, also built for the World’s Fair (1889), the Trocadero Palace and the sculptures that decorated the esplanade until 1937. A later photograph, by an unknown photographer, shows the Tower with the smaller version of the Statue of Liberty, then on the Pont Grenelle, while another, dated 1948, depicts an incongruous visitor –an elephant no less- that seems to be wondering what it was doing there.

During the first week of the 1889 exhibition, before the lifts were in operation, 28,922 visitors climbed up to the first or second platforms. In 173 days, over 1,900,000 people visited the monument, an average of over 12,000 a day!

A theatre, a French restaurant and Russian restaurant, a Flemish bistro and an English-American bar were installed on the first stage. The second had a printing press which brought out a special edition of *Le Figaro* each day, alongside shops and drink stalls. At the very top, two crisscrossed arches held the lantern from a lighthouse and a three-branched lightning conductor stood on the narrow platform that crowned the summit at exactly 300 metres altitude.

Gustave Eiffel installed his office on the top platform and planned three laboratories respectively for astronomy, physiology and meteorology. Indeed, from the very outset, Eiffel had constantly said: “Apart from these spectacles that improve the mind, the Tower will have varied applications, either for national defence or in the scientific field”. His deep interest in scientific research was compounded by the engineer’s dream of making his monument indispensable to spare it demolition when the twenty-one-year concession expired. Many experiments were carried out. He was particularly concerned by the effects of wind on the structure, which were still poorly understood; he tended to overestimate them since he thought that the top of the tower would sway 70 centimetres whereas it in fact has never exceeded 15. But Eiffel was haunted by the accident at Tarbes in 1884, when the viaduct he was building was blown into the valley during a storm. As a result he had an apparatus installed in 1903 between the ground and the second platform of the Tower to investigate air resistance on falling bodies. But was its role in the development of the wireless that gave the Tower decisive strategic value and saved it from demolition.

In 1910, the concession was renewed for seventy years.

A Symbol of Paris and Modernity

“The Tower is a symbol of Paris but it could be said that it won that place in opposition of Paris itself, its old symbols, just as physically it dominated their domes and spires in short, it became the symbol of Paris only when it raised the mortgage of the past and thus became the symbol of modernity. Its very aggression on the Paris landscape (underlined by the artist’s petition) became welcoming, the Tower, with Paris itself, has made itself the symbol of creative daring, it was the modern gesture through which the present said not to the past”, wrote Roland Barthes in *La tour Eiffel*, published in 1964.

Once the monument was completed, several of the people who had signed the 1887 petition made amends, such as Sully Prudhomme who admitted he had “judged and condemned only by default painters (Georges Seurat, Henri Rousseau, Robert Delaunay, and Marc Chagall, to name but a few), engravers, poets, and film-makers adopted the tower, represented, cited and drew it and made their characters climb it. René Clair twice yielded to its charms, first as a setting for “Paris qui dort”, a fiction film made in 1923 and then with a documentary soberly entitled “La tour” in 1928.

A few years earlier, Gabriel Loppé (1825-1913), a former pupil of the Swiss landscape artist Francois Diday, who turned to photography in the 1880s, used artificial lighting to produce urban views which presaged those of the American photographer

Alfred Stieglitz. From the balcony of his apartment in the Avenue du Trocadero, the Eiffel Tower was an excellent subject, whether lighted or revealed in a flash of lighting. When she was in Paris in the 1920s, the German photo-journalist Else Thalemann (1901-1985) took photos of the tower that are astoundingly modern in their framing. Although the structure of the monument can still be seen on some shots other give an abstract view infused with great visual poetry.

An engineering achievements par excellence, the Tower gave rise to astonishingly modern photographs. Although they were taken with monument, Durandelle's photographs exceeded their original function and established a new form of photography in which the void, triangulation and lines making complex networks are the main axes. By the effects of repetition, accumulation and series, they were forerunners on the experiments at the Bauhaus or of futurism, and the more recent work of Bernd and Hilla Becher, German photographers born in the 1930s who systematically recorded industrial buildings –silos, water towers, furnaces- with the emphasis o inventory, anonymity and the play of structures. Henri Rivière's photographs, thought they have obvious formal links with those taken by the Russian constructivist artist Alexander Rodchenko (1891-1956), also call to mind the work of Lewis Hine (1874-1940), especially the American photographer's reportage on the construction of the Empire State Building in 1930.