

Progress on display: Universal Exhibitions in the second half of the 19th century

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second half of the 18th century, were always considered an important means of promoting the industrial development of countries and diffusing technical and industrial progress. After London organized the first Universal Exhibition, in 1851, this event category gained an international character. These exhibitions were also an opportunity to present new materials and building techniques. The Universal Exhibition was visited by a very diverse public from politicians and engineers to workers.

Keywords: Universal Exhibition, Science, Technique, Progress, Study visits

1. Introduction

In recent years, Universal and International Exhibitions have enjoyed growing interest among historians from various fields. Such interest may in part explained by the diversity of ways in which these events can be approached: while they were important in the evolution of the economy and the internationalization of trade, they also played a decisive role in the diffusion of technical and scientific advances and in the layman's contact with those advances. Other aspects still must be considered when looking at Universal Exhibitions, such as the case of political mediation or the links between these events and the development of architectural styles or museums (Matos et al., 2010).

2. From Industrial Exhibitions to Universal Exhibitions

always considered an important means of promoting the industrial development of countries and diffusing technical and industrial progress. After London organized the first Universal Exhibition, in 1851, this event category gained an international character.



Fig. 1: View from the Knightsbridge Road of the Crystal Palace in Hyde Park for Grand International Exhibition of 1851. Dedicated to the Royal Commissioners, London: Read & Co. Engravers & Printers, 1851.

When we look at the chronology of universal exhibitions we see that, up until the 1870s, they were held in either London or Paris, the capitals of those countries which retained the economic power of Europe.

Table 1 - Universal and Industrial Exhibitions held in the second half of the 19th century

Year	Universal International	Place	N° of visitors
1851	Universal	London	6.039.195
1853	Universal	New York	
1855	Universal	Paris	5.162.330
1862	International	London	6.096.617
1865	International	Paris	
1867	Universal	Paris	11.000.000 to 15.000.000
1873	Universal	Vienna	7.255.000
1876	International	Philadelphia	10.000.000
1878	Universal	Paris	16.156.626
1880	International	Melbourne	1.330.000
1888	International	Barcelona	2.000.000 to 2.300.000
1889	Universal	Paris	32.250.297
1893	Universal	Chicago	27.500.000
1897	International	Brussels	6.000.000
1900	Universal International	Paris	50.860.801

Source: (Schroeder-Gudehus and Rasmussen, 1992)

Table 1 - Source Schroeder-Gudehus and Rasmussen.

Only in 1873, after the Franco-Prussian Empire was constituted, did Vienna hold its first Universal Exhibition. Paris was again the venue for subsequent universal exhibitions, in 1878, in 1889 and in 1900, but London only saw, in 1870, an international workers' exhibition.

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Fig. 2: New York Crystal Palace designed by Karl Gildemeister. The image is an "oil-colour" plate by George Baxter, London, dated 1 September 1853.

Outside the European continent, the first universal exhibition took place in New York, in 1853. In 1876, the celebration of the American Independence Centennial provided the pretext for organizing an exhibition in Philadelphia.

The differences between universal and international exhibitions were not always clear. Thus, the exhibitions held in Philadelphia in 1876, in Melbourne in 1880 or in Barcelona in 1888, although they were called "international", are usually counted among universal exhibitions due to the number of visitors and the impact they had on international trade and on their host cities.

The second half of the 19th century also

saw various theme exhibitions, as was the case of the one on electricity held in Paris in 1881. These exhibitions were in line with the advances made in several fields of knowledge, of which electricity was an important example.

3. Universal Exhibitions and the diffusion of science and technique

Organized at a steady rhythm throughout the 19th century, universal exhibitions (table 1) were a place where scientific, technical, and industrial advances were publicized - especially those which might find applications in industry or contribute to the advancement of urban spaces and everyday life. Donald Cardwell considers that universal exhibitions are important for the history of technology and, in his own words, "the exhibitions, taken as a whole, give some impression of the 'state of the art' in the various technologies" (Cardwell, 1994: 304, 285).

Universal exhibitions also served as a means of disseminating and globalizing science and technique, a fact which was stressed by Prince Napoleon at the time of the 1855 Universal Exhibition in Paris: "o problema do futuro consiste em fazer partilhar à universalidade o que até aqui tem sido reservado para o pequeno número" (Diário do Governo, 1861: 1163).

In this dissemination, the role of the press became increasingly important, and for this reason, the editorial capacities of the various countries assumed a great weight in the 1855 Exhibition. In that event, books were considered the expression of national cultures and provided the standard for appraising the different countries' degrees of "illumination" (Lisboa, 1924: 138-139). King Pedro V himself, in the journal of his travel to that exhibition, mentions this fact when he praises French typography which, thanks to the inclusion of pictures among the texts, had contributed to "the spreading of knowledge in mechanics, mathematics, and natural sciences" (Lisboa, 1924:

149). In those days, however, the great novelty was photography (Souto et al., 2012). Considered one of the symbols of the "intimate link between science and the arts" (Damásio, 1854: 250-251), photography appeared in the Paris Universal Exhibition of 1855 as the representational art of the future. And in the Paris Universal Exhibition of 1900, the Lumière brothers' animatography was seen as a way of surpassing distances and bringing the peoples of the world closer together.

Universal exhibitions permitted countries' economic powers to be compared. The awards collected, along with the evaluation of each country's participation, worked as a way of placing them in a hierarchy regarding technical, scientific, and industrial matters. In the Universal Exhibition held in London in 1851, Great Britain, which obtained 78 gold medals, was considered the most developed nation in industrial and technical terms, followed by France with 52 medals. Nevertheless, as mentioned by Adolphe Blanqui, who represented the Paris Royal Academy of Science during the London Exhibition, for the French, the main result of the Exhibition is the universal, absolute and undisputed recognition of their superiority in terms of art and taste (Bergeron, 1998: 21).

Throughout the second half of the 19th century many international exhibitions were held, several of them thematic in nature like the exhibition on electricity hosted by Paris in 1881. This stemmed naturally from the scientific advances occurring in certain areas, and their subsequent technological applications.

The recreational character associated with universal exhibitions assumed growing importance in the second half of the 19th century. In the 1889 Exhibition, various voices criticized an excess of recreation, which tended to relegate to a secondary position the goals which had initially guided these events. The 1900 exhibition confirmed this trend, leading someone to complain that «De plus en plus les expositions universelles perdent leur premier caractère (...). L'Intérêt de l'industrie et du commerce n'est plus que

le prétexte, l'amusement son but »² (Mattelart, 1994: 150).

4. A "stage" for showing advances in construction techniques and materials: from Crystal Palaces to the Eiffel Tower

By demanding the construction of a series of pavilions for showing their machines and products, exhibitions brought to light the development and use of new materials and building techniques - a case in point being the Crystal Palaces, which showed the association of glass and iron.



Fig. 3: Paris Cristal Palace 1867. Photo of anonymous author. Library of Congress: Prints and Photographs Division

Some of these constructions, e.g. the Palace of the Paris 1867 Universal Exhibition, were ephemeral, while others resorted to the idea of prefabrication, allowing them to be disassembled and later reassembled somewhere else, e.g. the Crystal Palace of the London 1851 Universal Exhibition, which was subsequently moved to Sydenham, on the city's outskirts. Still, others led to the development of prefabrication techniques, as was the case with the Eiffel Tower. Some of the buildings that stood the test of time became symbols of the cities in which they were raised: the Eiffel Tower, built for the Paris 1898 Universal Exhibition, and both the Grand and the Petit Palais, made for the 1900 exhibition held in the same city, which became, respectively, an important exhibition centre and a museum of the decorative arts.



Fig. 4: Petit Palais, Published in N.D. Exposition Universelle de 1900, an album of 50 fine photographic views. Paris: 1900. This image is available from the Brown University Library under the digital ID 1303845244984376.

The Eiffel Tower and the Halle des Machines, built for the Paris 1898 Universal Exhibition, were crucial in affirming the use of iron and steel in modern construction, thanks to the demonstration of their multiple constructive potentials. The command held by engineers over new materials and their skills in mechanics and strength of materials were evident in these buildings and, consequently, the triumph of iron architecture in this exhibition resulted in a stronger affirmation of engineers.

Universal exhibitions also served to make known other building materials. The 1878 exhibition helped demonstrate the growing importance of Vicat and Portland cement in public works, while the 1900 exhibition definitively asserted the use of concrete.

5. Meeting and confrontation of different countries

Universal Exhibitions were often seen as places of gathering for peoples from different parts of the globe, with the coexistence of countries assuming a peaceful character. Nevertheless, these exhibitions were also, as mentioned by Armand Mattelard, « un endroit autour duquel se cristallise la peur de l'autre »³ (1994: 148) - not only because the coming together of people brought along fears of epidemic contamination, but also because the show-off of each country's military and industrial power was a way

of measuring the respective strengths of the various countries attending these events.

In 1878, in the aftermath of the Franco-Prussian war, the Universal Exhibition held in Paris was considered by the newspaper *Tages Press* to be a great moral victory for France. The newspaper *Nouvelle Presse Libérée*, for its part, saw this exhibition as a truly political event, a revenge more splendid and lasting than any political victory. The *Gazette d'Augsbourg*, in turn, stressed the fact that, in the space of just seven years, France had managed to recover from the war and to give through this exhibition a good picture of its productive capacities. From London, Eça de Queirós wrote: « desde que a Exposição se abriu, e que a França celebra em Paris a sua grande festa de ressurreição, toda a Europa tem um tom mais calmo; (...). Exala-se da Exposição, parece, uma emanção de concórdia, de trabalho, de civilização que enche os espiritos de um salutar desejo de fraternidade e de paz »⁴ (Queirós, s/d, p. 340).

At the end of the 19th century, when the conquest of colonial markets increased the tension among the most industrialized European countries, the presentation of their warfare-related industries assumed special relevance.

6. Study visits and recreation visits

Interest in these exhibitions arose among the populations of several countries, leading to visits by a numerous and diversified public. Thus, alongside engineers and entrepreneurs looking for technical novelties, and intellectuals concerned with the material expression of the current culture, the space of the exhibitions also received members of various countries' elites, in addition to a multitude of people full of curiosity, for whom the manifestations of science and technique were both marvellous and incomprehensible. The London Universal Exhibition of 1851 was visited, during its 141-day span, by 60.000 people. Some 50 years later, the Paris Universal Exhibition

of 1900 received 8 times as many visitors. Since exhibitions were spaces of diffusion for technical, industrial, and agricultural progress, national governments appointed committees charged with studying the advances made in the various sectors of the economy. In the committees appointed by the Portuguese government, chemists, engineers, and agronomists had an outstanding role, as they possessed the skills required to evaluate the advantages of the technologies presented, and to indicate which of these were best suited to satisfy the country's needs (Matos, 2004).

A decree dated March 29th, 1855 appointed a committee that should study, at the Paris Universal Exhibition of the same year, “progressos e melhoramentos das diferentes artes e ofícios, a fim de que os esclarecimentos e indicações que se colhessem servissem para guiar a indústria nacional, encaminhando-a no seu desenvolvimento e aperfeiçoamento sucessivos”⁵. It was made up of five scholars and an administrative official, all of whom were trained in chemistry and/or engineering.

Committee appointed to study the Paris Universal Exhibition of 1855

Name	Training	Activity pursued at the time of the appointment	Studies required at the exhibitions
Júlio Máximo de Oliveira Pimentel	Chemist	Professor at Instituto Industrial de Lisboa	Chemical industries
José Vitorino Damásio	Engineer	Interim Director of Instituto Industrial de Lisboa	Steam engines and railways
Sebastião Belémio de Almeida	Chemist	Escola Industrial do Porto	Chemistry
João de Andrade Corvo	Engineer	Professor at Instituto Agrícola de Lisboa	Agricultural machinery
José Maria da Ponte e Horta	Engineer	Professor at Escola Politécnica de Lisboa	Steam engines
Sebastião José Ribeiro de Sá	Engineer	Head of the 'Repartição das Manufaturas' at the Ministry of Public Works, Trade and Industry	Agricultural products, machines, and tools

Table 2: (Matos, 2012: 304)

The committee appointed to study the London Universal Exhibition of 1862 was required to produce reports on the advances concerning industrial mechanics, with a special focus on engines, spinning and weaving machines, railroad materials and the manufacture of wagons and means of transportation for ordinary roads.

In 1878, one of the main issues faced by the railroad network was the installation of narrow-gauge railways. So the

engineer Cândido Xavier Cordeiro, who was intensively involved with Portuguese railroads - namely the one linking Porto and Braga - was appointed to study that issue at the Paris Universal Exhibition (Carvalho, 1906: 363).

The fact that exhibitions were seen as an efficient way of instructing workers, based on direct observation of machines and industrial objects, led several governments to send representatives of the various industries to universal exhibitions (Matos et al., 2010). With that aim, in 1855 the Portuguese government required the director of the Instituto Industrial de Lisboa to choose 10 workers - 5 from Lisboa and 5 from Porto - to visit the Paris Exhibition at the government's expense. In Porto, the representatives of the various industries were selected by the Associação Industrial Portuense.

In the wake of these exhibitions, some museums were created which extended in time the diffusion of each country's scientific, technical, and industrial advances, and whose goal was to support the instruction given by establishments of technical education. The Universal Exhibition of 1851 gave rise to the first science museum - the South Kensington Museum. When the exhibitions closed, the conservatories of arts and trades and the museums of technology and industry requested the offer of many of the objects which had been on display, thus contributing to the transfer and spread of technology.

7. Exhibitions and congresses: from progress in new scientific fields to the implementation of international procedures

Universal exhibitions thus acted to attract science congresses which discussed many of the main issues faced by civil societies and national economies. As the 19th century wore on, the number of congresses held simultaneously with exhibitions increased. Focused on areas such as rail transportation and

electricity, they contributed to defining international norms and procedures in fields such as communications, transportation, and energy. For instance, the congress on industrial property held at the time of the 1873 Vienna Exhibition proposed the first international convention on patents. In 1878 was organized, simultaneously with the Paris Exhibition, a congress on literary property, presided over by Victor Hugo, which resulted in the creation, in 1881, of the Berne International Union for the protection of literary and artistic works. These congresses gave visibility to the world of science and stimulated the appearance of emerging sciences (Rasmussen, 1989: 23-44) such as statistics and anthropology (Benedict, 1983; Corbey, 1993).

8. Conclusion

The Universal and International Exhibitions held throughout the second half of the 19th century were important means for the diffusion of scientific, technical, and industrial advances and, being open to the general public, they contributed to the globalization of science and technique (Lafuente et al., 1998: 31-38). The buildings required by the exhibitions helped affirm new architectural styles, advances in building materials and techniques, and the role of engineers as a professional category. The congresses which accompanied these exhibitions contributed to the affirmation of new scientific areas, and to the establishment of international norms.

These events, which were decisive in defining a new relationship between science and the public (Bensaude-Vicent, 1993) contributed to a wider acceptance, by people who lacked technical training, of innovations linked to both the urban and the domestic spaces.

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¹ “the challenge of the future consists of sharing universally that which has, so far, been kept to a few”

² “Increasingly, universal exhibitions have been losing their primitive characteristics (...). Interest in industry and trade is merely a pretext, the main goal being recreation... “

³ “A place where fear of the other crystallises”.

⁴ “Since the Exhibition opened, with France celebrating in Paris its great feast of

resurrection, the whole of Europe enjoys a calmer tone; (...). It seems that the Exhibition exudes an emanation of concord, of work, of civilization, which fills the spirits with a healthy desire of fraternity and peace”.

⁵ “The progress and betterment of the different arts and trades, so that the clarifications and hints thus obtained might guide the national industry, directing it in its continued development and improvement”.

Post-print version