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# Great Greenhouse of the Coimbra Botanical Garden: a jewel of iron and glass

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“Each true work of art occupies a thick and multi-layered time rather than mere contemporaneity.”

Juhani Pallasmaa\*

This was decidedly a long-awaited work in the city of Coimbra. Therefore, when on March 21, 2018, at 4:15 pm, the ceremony for the reopening of the Great Greenhouse of the Botanical Garden of the University took place, symbolically indicating a date which, corresponding to the spring equinox, allowed opening to the public of an infrastructure whose remodeling had already finished the previous year. This intervention action of renovation of the main greenhouse aims to be the motor for the valorization of a space that gathers in its heart a splendid and particular suit of arboreal and shrub species like the one that exists spread throughout the Botanical Garden, even at the doors of the academy.



1. Photo of the exterior of the Greenhouse of the Botanical Garden by Augusto Bobone, dated 1902.

A botanical garden is a peculiar space that, due to its collection of plants, allows a contact with what is the flora of many different geographic regions, provoking a kind of terrestrial vegetal condensation. In its genesis, this garden, directly associated with university activity, was the result of an illuminist spirit that proclaimed a full faith in reason where, among other things, learning should be mainly established in an interactive process of observation and demonstration<sup>1</sup>. From the analogical point of view this type of garden corresponds to a kind of living museum of the planet. And somehow, in the context of a space of this nature, the existence of a greenhouse is aimed at enabling certain species whose



2. Image of testimony of the works of remodeling of the interior of the Greenhouse of the Botanical Garden on May 16, 1932.

\* Quoted from *Essências*, Editorial Gustavo Gili, Barcelona, 2018, p. 32.

<sup>1</sup> Brites, Joana, "Botanical Garden of the University of Coimbra: from Vandelli to Júlio Henriques (1772-1873)", *Arquivo Coimbrão*, volume XXXIX, Coimbra, 2006, p. 12.

development would not be possible in outer space, and it is imperative to create special conditions for their survival.

The space initially occupied by the Botanical Garden absorbed a considerable area of the old fence of the College of St. Benedict whose land was donated to the university by the Benedictine friars. This donation, more than an act of beneficence, resulted mainly from the will on the part of the order to control damages since there was the panic that they were taken possession of the school and of all its fence<sup>2</sup>. From 1774, two years after the beginning of the Pombaline Reform of university education, the space reserved for the garden was the object of very deep topographical changes. The garden, then under the initial responsibility of the Italian naturalist Domingos Vandelli (certainly helped by Júlio Mattiazi, gardener of the Royal Botanical Garden of Ajuda), who also participated in its design, followed the purpose of bringing together in the space all types of plants, with particular accuracy of the medicinal and representative

<sup>2</sup> For a rigorous synthesis of the history of the garden we suggest the consultation of Brites, Joana, "Botanical Garden of Coimbra: counterpoint between Art and Science", in *Transnatural*, SersilLito, Maia, 2006, pp. 31-69; for the episode at hand see p. 33.



3. Exterior of greenhouses using the whitening process, prior to the recent restoration work.

of the Portuguese Overseas Domains.<sup>3</sup> This drawing presents notorious influences from the Botanic Garden of Padua, to which the native provenances of Vandelli and Mattiazi will not be alien, and even the latter was a gardener.<sup>4</sup> The original project which appears to be of disproportionate opulence and grandeur could cause

<sup>3</sup> The creation of the Botanical Garden appears with a doctrinal purpose in the *Statutes of the University of Coimbra* of the year of 1772, Book III, Regia Officina Typografica, Lisbon, 1773, p. 390-391.

<sup>4</sup> Brites, Joana, "Botanical Garden of the University of Coimbra: from Vandelli to Júlio Henriques (1772-1873)", pp. 20-22.

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4. Image taken during the demolition of the gallery in reinforced concrete of the central body of the Greenhouses of the Botanical Garden.



5. Photo during the process of recovery of the iron structure.



6. Plan, cut, and southern elevation of the Botanical Garden Greenhouse.

great difficulties to the finances of the university, necessitating the interference of the Marquis of Pombal, and his position of principle is known "that things are not good, because they are expensive, and magnificent; but rather, and only, because they are proper, and suitable for their use must be done."<sup>5</sup>

<sup>5</sup> Extract by Marquis of Pombal in *Laboratórios do Mundo, ideias e saberes do século XVIII*, Lisbon Science Academy, Lisbon, 2004, p. 96.

From 1791 the garden was under the guardianship of the professor of botany and agriculture Félix Avelar Brotero (responsible for the extension of the area with the acquisition of a farm of the Marian priests). It is from that same year a project for the greenhouses of the garden, of moderate ambition, in a very close place to the one occupied by the present greenhouses, signed by Manuel Alves Macomboia who at the time already assumed himself as architectural professional and who had a very important role in the concretization building at the university in the late 18th century.<sup>6</sup>

Later, it would be during the direction of Henrique do Couto d'Almeida, whose mandate ran from 1854 to 1867 that would arise some larger constructive increases in the Botanical Garden, such as the flights of stairs on the south side or the implementation of grids of the plans of the various platforms, the great work would actually be the construction of the Great Greenhouse. The present greenhouse was designed by the engineer Pierre-Joseph Pezerat (1801-1872)<sup>7</sup>, and the solution was presented in 1854 and completed eleven years later. The risk, which was developed in graceful terms, presented a symmetrical solution, composed of three bodies that allow the implementation of different temperatures and conditions.<sup>8</sup>

The nature of the solution followed the line of other European structures designed for the creation and preservation of plants likely to perish in an environment that was not close to its natural. In this type of infrastructure the use of modularized structures using iron and glass was recurring, which in the context of a city like Coimbra would certainly be a testimony of the tremendous local technological development. This type of solutions was also the first step, not being a type of construction that would be the responsibility of any author, given the precision of design and the fact that its design has to deal with relatively extreme climatic conditions, regulated in our case by reasonable thermal amplitude with hot summers and winters, usually without snow but with frequent frosts, with sometimes negative temperatures. For the construction of the greenhouses of the University of Coimbra, a contract was signed in July 1857 with the Industrial Institute of Lisbon, but only in 1859 did the first part of the structure arrive in the city, whose assembly would

<sup>6</sup> Consult Craveiro, Lurdes, *Manuel Alves Macomboia, Arquitecto da Reforma Pombalina da Universidade de Coimbra*, Art History Institute, Faculty of Letters of the University of Coimbra, Coimbra, 1990.

<sup>7</sup> This technician of French nationality who would take the name of Pedro José Pezerat, after passing through Brazil at the service of the King D. Pedro and through Algeria where he worked for the French government, settled down in Portugal working as engineer in the City Hall of Lisbon from of 1841, position that he assumed until his death.

<sup>8</sup> Henriques, Júlio Augusto, *Botanical Garden of the University of Coimbra, The Institute*, volume XXIII, 2nd series, University Press, Coimbra, 1876, p. 157.

only be possible by contracting specialized workers coming from the capital. This task, which proved to be time-consuming, very motivated by lack of means, dragged the works and probably would be reason for the designated second phase to be commissioned to the Factory of Foundry of Massarelos, located in Porto. In spite of this contingency, the project was respected, and the delicate work of building the three bodies of the greenhouse was only concluded in 1865. From this date onwards, and existing optimized conditions for planting species until then only seen in their original territory, there were conditions for Antonino José Rodrigues Vidal to lead the garden from 1868 onwards, to keep alive the generalized exchange of seeds, in view of the growth of the natural collections made available.

Thus, the conditions for the great revolution were created, which would be carried out by Professor Júlio Henriques, who was asked in 1873 to conduct the politics and destinies of this space, a responsibility that was honorably performed even during the course of the First World War. Through a very determined action was intensified the exchange of plants with homologous institutions around the world and systematic collection



7. Aerial photograph of the Botanical Garden Greenhouse with small greenhouses on the upper platform to the north.

of seeds that allowed the development of a diversified set of species that today have a large size in the garden making it a very prestigious institution and with recognized quality. With this illustrious botanist, the garden was able to find the methodical way for its confirmation as a privileged place for the study of

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8. Main staircase of the Botanical Garden with east access zone to the greenhouse platform.

species very much in line with the principles enunciated by Charles Darwin, certainly guided by a knowledge of scientific matrix and a very practical and observing method of teaching.

From 1918 the destinies of the garden were in the hand of Luiz Wittnich Carrisso, who developed very determined actions of regeneration of teachers and consequent renewal of the teaching. But what is important for these effects is the extensive reformulation of the heating system of the Great Greenhouse, causing profound changes in the flora planted there and especially introducing in the small greenhouse, built shortly after the main one, the current ex-libris of the garden, a unique example in Portuguese botanical gardens: the Amazonian Victoria, also known as *regia*.

Although the references are scarce, as part of the interventions of the Administrative Committee of the Plan of Works of the University City (CAPOCUC), along with the numerous transformations that took place in the uptown from the 1940s onwards, some transformations were also made in the Botanical Garden. If we mention the construction of the Cold Greenhouse and the implementation of furniture in stone, both designed by Cottinelli Telmo, chief architect of CAPOCUC, or the remodeling of the central square, it is worthy of reference the installation of a central heating installation that globally has remained to this day.<sup>9</sup> Then the botanical garden improvements were very limited until the extinction of CAPOCUC in 1969, and it did not cease to continue this way or becoming worse, after the implementation of the democratic regime, which gradually removed the protagonism of the Botanical Garden, allowing the irreversible effects of time to leave ballast and to become more and more imperative a structured intervention that would regain a fascination

that was important to place in the field of the real and the memorable.

It seems that the design of the Coimbra Tropical Greenhouses was directly influenced by the greenhouses built at the Royal Botanical Garden of Kew (Kew Gardens) in London and completed in the mid-nineteenth century. From a typological point of view, the greenhouse that most resembles that of Coimbra is called Palm House<sup>10</sup> consisting of a square central body and two rectangular ones placed along the same axis. However, there are two other greenhouses, the Temperate House and the Waterlily House, of later implementation, with imagery very different from the previous one and that constructively are closer to the methodology adopted in the Portuguese greenhouse.



9. West side of the Tropical Greenhouse with lake in space coinciding with the old small greenhouse and Science space in situ on the left.

For example, one of the greenhouses, the Waterlily House, which was completed in 1852 and served, as today, to expose the giant water lily, called *Victoria regia*, originally from the equatorial region of the Amazon River Basin, whose name honors Alexandrina Victoria, Queen of the United Kingdom from 1837 to 1901. Curiously, the Waterlily House has a solid rock punch at the foundation, a solution similar to that later built in Coimbra, confirming that Pezerat, as a highly educated man who travelled across continents, should have studied the interventions in the London Botanical Garden with some acuity, making with his proposal a kind of composite synthesis.

Reaching the 21st century with a structure as slender as the greenhouse of the Botanical Garden of Coimbra, underappreciated and with obsolete infrastructures that hindered its use, it was important to give it new

<sup>9</sup> Brites, Joana, "Botanical Garden of Coimbra: counterpoint between Art and Science", pp. 60-66.

<sup>10</sup> This greenhouse, designed by the architect Decimus Burton, was built between 1844 and 1848 by Richard Turner.



10. Photo of the main body of the greenhouse with active shading system.

protagonism and to find within that important green space of the city, a proper place that could allow its highlight in accordance with the value of this infrastructure. Having been recently recognized as World Heritage, what was at stake was preserving its identity, enabling it to perform the function for which it was designed and thus, at the same time, constitute a pole of attraction based on its genuineness. As a basic methodology, it was convenient for the garden to start to have more plants from tropical humid regions,

creating dialectic around the preservation of endangered species, or simply implementing educational processes showing plants that give rise to everyday products such as coffee, cocoa or mango.

In a public tender process, it quickly became apparent that the proposal presented by the team led by the architect João Mendes Ribeiro, brought to that complex a breath of fresh air that intends to preserve the image of the Pezerat greenhouse, freed it from some peculiarities that time and mankind added, but somehow altered the physiognomy of that greenhouse which symbolized in its genesis an illuminist ideal. Restoring and rehabilitating the tropical greenhouses was almost an emergency action, allowing to bring to the space new public and to give optimized conditions for the development of rare or exotic plants. In the imaginary of the people, there was a frozen image of cyclically watching the whitening of the numerous glass planes, protecting the interior from the harmful action of the summer sun and its removal during the winter to allow the direct entrance of light. This alternation, which could be imagined as a ritual founded from the time of the construction of the greenhouse, was a pragmatic and

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11. Interior of the Tropical Greenhouse with transparency and luminosity perception of space.

economic response to the degradation of a system of screens whose obsolescence had condemned to its disappearance. That is, the architect João Mendes, Ribeiro, doing some research on the origin and use of the building, found that the poetics of the whitening of greenhouses was a more recent process and that from a technical and aesthetic point of view a return to the origins was imperative.<sup>11</sup> This option, which is clearly a guiding motor of this project, brought to the interior of the greenhouse a nature that being engaging was usually very distant from the eyes and the senses. Very focused on environmental sustainability, there was a great concern in the intervention to preserve an image that certainly ascends to its iconic role, but which, especially when using technical solutions that are not intrusive, guarantee a necessary and imperative functional efficiency. The replacement of the previous thin glass by thicker glass, laminated and with thermal cover, allowed to guarantee the levels of transparency and to increase the safety and the energetic efficiency of the interior of the greenhouse. By complementing this fixed medium with discreetly applied dynamic systems made up of rolls of fabric, the levels of sun protection increased whose devices can be used partially and oriented, facilitating the expected environmental controls. The replacement of glass was only possible due to the revision of the whole iron structure of the greenhouse, forcing the individual design of each plate, in a universe of about five thousand units. The accurate work of pickling, metallization and convenient painting forced the verification and eventual replacement of all the connecting elements, to the revision of all the different profiles, including gutters, rods and pillars, firming the excellence of all the structural component, confirming its capacity to absorb new loads and all expected project performances. Since the three bodies of the greenhouse were expected to operate under different conditions of heat and humidity, it was crucial

to introduce sophisticated and automated systems that would enable continuous and mechanical operation without major human intervention. In the case of the heating system, its modernization was made taking into account the possibility of being able to use part of the mass resulting from pruning of trees in the garden, having opted for a boiler fueled with organic fuel.

Complying with the demanding requirements of temperature, light and humidity, through the use of highly transparent glass, can the plant and human nature, infect all flora that also extends into the greenhouses, leaving the building reduced to a kind of skin that regulates environments but which effectively constitutes a border more psychological than conscious limit. And, had it not been for the subtlety of the steel profiles that ensure the support of the glass, we could practically be tempted to pass that physical barrier. This new image of apparent radicality compared to the previous one is in itself a solution that better integrates that structure built with the wisdom of mankind and which, in defiance of gravity, is made to control and simultaneously disappear.

Establishing a reorganization of the entire greenhouse, no doubt the most dedicated work fell on the central body. Victoria being an exuberant plant and almost a brand image of the garden, the architects opted for an apparently radical solution that was the dismantling of the old small greenhouse located to the west and rescued the giant water lily to a place of enormous centrality and apparatus. In the case of the small greenhouse, this square was transformed into an outdoor tank with perimeter bench in stone, defining a pleasant area to be, allowing a great open view and facilitating the connection between the Tropical Greenhouse and an adjacent body called Science in situ of services with public toilets. This last building, built from scratch, has a flat, landscaped roof and presents an image very defined by a limestone structure and aged pine wood of Riga, subtly reinforced by discrete steel beams. In another aspect, denoting sustainability concern and trying to create some more events in the garden, in view of the development of a specific area for succulent plants and cacti, two small greenhouses were developed located in a platform to the north and adjacent to the main greenhouse. These constructions were complemented by two kinds of inverted umbrellas which collect rainwater and a buried tank and which could be used for irrigation of the above-mentioned plants or for other situations that may be justified in the context of the garden. The whole intervention is the corollary of an accurate architectural elegance, reflecting a peculiar unity and coherence, acquiring a character of

<sup>11</sup> See João Mendes Ribeiro / 2003-2016, Uzina Books, Lisbon, 2016, pp. 212-227.



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exceptionality, very marked by the specific place where the project is developed, that helped to determine the form and the drawing.<sup>12</sup>

With the option of highlighting the *Victoria regia* and simultaneously redesigning the central body, replacing old flowerbeds with a generous tank with water, an artifact is created in this space that unequivocally acquires a differentiating status. This kind of lake, whose surface of water develops to the height of the pavement, is coated with steel plate painted in black, aiming to emphasize the water plane.<sup>13</sup> A water surface that will provide the cyclical mutability of a large plant, whose exponent begins with the enormous size of its leaves and is confirmed with a very short flowering but going through several colorations. Being aware that due to the size of this Amazonian water lily, its observation would be facilitated and increased through a higher quota view. In fact, the spectacularity increases substantially when the vision is made so that it perceives better the real form of each leaf that resembles a Petri plaque<sup>14</sup>, reason why this circumstance fully justifies the implementation of a high and perimetral balcony.

Being known the architect's connection to the scenic devices, confirmed by an extensive and fruitful connection to the theater, the whole design approach within the project in the Botanical Garden was developed in order to value all the existing infrastructures and, at the same time, its recreation.

With the rehabilitation of the Great Greenhouse of the Botanical Garden, remarkable construction of iron and glass, the University of Coimbra managed to put the Botanical Garden in a very favorable situation both in relation to research and to the confirmation of this space as a place of pedagogical and playful interest. The solution found by the architect João Mendes Ribeiro, corresponding to a kind of return to the origins, masterfully plays in the duality that glass has in some circumstances to be totally transparent and in others to be a surface of reflection or almost opacity. Everything results from the environmental situation where we are and from which the most luminous environment. In this order of reason, we can speak both of interior space and of outer space, and may even say that the greenhouse is part of the place that surrounds the Botanical Garden, as in some circumstances is a place apart. But, regardless



12. Interior view of the central body of the greenhouse taken from the upper gallery with *Victoria regia* to the center of the lake.



13. Detail of the start of the helical staircase for access to the upper gallery, with *Victoria regia* and reflection of the cover of the Greenhouse of the botanical garden.

of the thought, the greenhouse is a privileged place to reconcile with nature, knowing that in the middle of all this is good architecture. An architecture that respects the pre-existing constructive systems, which values them, seeking to develop a harmonious dialogue with the function that is intended to perform, leaving ideal conditions for our full enjoyment. The dedicated and meticulous work of João Mendes Ribeiro in the Great Greenhouse denotes a great concern of the architect to respond concisely to an order, offering visitors a contemplative relationship with nature, qualitatively functioning its proposal as a privileged and effective means of its proficient accomplishment.

And, nothing better for the confirmation of the relevance of the work and testimony of the quality of the intervention than its selection for finalist in the restricted lot of interior architecture works for the prestigious FAD Prize in its edition of 2018 and that awards the best interventions in the Iberian Peninsula, or the fact of having won the 2017 National Urban Rehabilitation Prize, in the area of the best Intervention with Social Impact. ■

<sup>12</sup> Tostões, Ana, "Neutro e excepcional ou o esplendor da verdade" in *João Mendes Ribeiro Arquiteto*, Edições Asa, Rio Tinto, 2003, p. 9.

<sup>13</sup> João Mendes Ribeiro / 2003-2016, p. 213.

<sup>14</sup> A box or petri plaque is a cylindrical, flat container, usually made of glass and widely used in a laboratory environment.