Exhibition design and lighting: notes on the genesis of the debate between conservation, public emotion, and care

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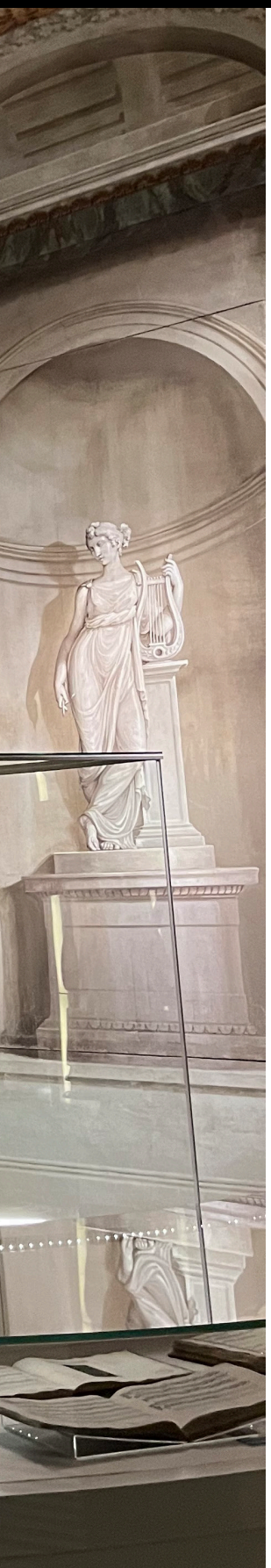
Keywords:
Light design, Care, Museum displays, Architecture, Public perception.



ABSTRACT:

In 1969, a group of museum professionals from the United States decided to found the International Association of Lighting Designer (IALD), marking both the emergence of a new profession and the rising importance given to the topic of light inside exhibition spaces. If the complex relationship between the preventive conservation of exhibited artworks and the visual comfort of the public is at the origin of the first considerations of light as an essential tool for museums, today's light designers' projects shed new light on the topic by offering new horizons - such as the importance of environmental care- and by improving the design, technologies, and knowledge behind the art of illuminating museums. As such, this article tries to retrace the evolution of the reflection toward museum illumination by highlighting its constant relationship with our different perspectives of "care".

Nel 1969, un gruppo di professionisti museali statunitensi decise di fondare l'International Association of Lighting Designer (IALD), segnando sia la nascita di una nuova professione sia la crescente importanza attribuita al tema della luce all'interno degli spazi espositivi. Se la complessa relazione tra la conservazione preventiva delle opere d'arte esposte e il comfort visivo del pubblico è all'origine delle prime considerazioni sulla luce come strumento essenziale per i musei, oggi i progetti dei light designer forniscono una prospettiva rinnovata sull'argomento, offrendo nuovi orizzonti - come l'importanza della cura dell'ambiente - e migliorando il design, le tecnologie e le conoscenze alla base dell'arte di illuminare i musei. Questo articolo cerca quindi di ripercorrere l'evoluzione della riflessione sull'illuminazione museale, evidenziando il suo costante rapporto con le diverse prospettive del "care".

Opening Picture:

Fig. 6: Detail of the Multireflex light system installed inside the Museo internazionale e biblioteca della musica di Bologna, November 2024. In Italian museums, light often plays a double role, highlighting the exhibited works and enhancing the historical container that displays them.

Photo by Federico Maria Giorgi.

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The 4th dimension of architecture: how light entered the design of museum spaces

The importance of the light offered to collections has been a topic of artistic historiography ever since the 17th-century indications of Giulio Mancini and Vincenzo Scamozzi and the 18th-century debate on the lighting of the first exhibitions - temporary, laic and open to all - at the Salon Carré in the Louvre. Exhibitions that would, in those years, make zenithal lighting a fashionable subject among Parisian artists[1] and architects.[2] In the 19th century, the emotional possibilities offered by light variations inside an identical space would be explored in Art: we only need to recall Claude Monet's thirty-one canvases of Rouen Cathedral painted in different light conditions. Light, which contemporary debate has sometimes interpreted as the 'fourth dimension' of architecture, has since offered visual consistency to the spaces of collections, revealing their volumes and matter.[3] However, in time, it also started to create moods and atmospheres by conveying emotions to the spectator,[4] permanently balancing the needs of the spaces, the artworks and the public.

The following reflections do not intend to propose a technical analysis of the evolution of lighting systems used over time for exhibitions and museums[5] but rather to point out how the question of 'care', which is as topical as ever today, has been at the basis of some exhibition projects and of various theoretical reflections in the field of museology since the 1940s. At that time, curators' practice was confronted with two different and sometimes conflicting requirements: on the one hand, the essential need for adequate preservation of collections over time;[6] on the other hand, the increasingly important focus on public perception.[7] This priority toward the visitor - by now essential for the life of many museums – was emphasised, perhaps for the first time so clearly, in the Madrid conference of 1934. On this occasion, what can be considered the first handbook of museography[8] was produced under the coordination of Euripides Foundoukidis, Secretary General of the IOM (International Office of Museums).[9]

Internationally, Kruithof's now famous studies of 1941 aimed to scientifically identify 'pleasant' light and visual comfort by studying the relationship between the luminance and the colour temperature of the light source. It should be noted that the visual "satisfaction" identified by Kruithof was still partially validated by visual tests with LED illuminants published by Viénot, Durand and Mahler in 2009.[10] Still, at the beginning of the 21st century, James Druzik and Bent Eshøj[11] went over the main historical stages of the relationship between conservation and lighting to emphasise the opportunity to find standard reference models and more stringent regulatory guidelines to more safely process lighting in museums.[12]

Designing the lighting of a museum requires the search for harmony between different elements: perceptive, physiological and psychological factors of vision, but also "chromatic memories that have been sedimented in western culture".[13] In Italy, it also implies, es-

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Fig. 01: Detail of the Multireflex light system installed inside the Museo internazionale e biblioteca della musica di Bologna, November 2024. The lighting system takes full advantage of the physical characteristics of the rooms, in particular their height, so that they can be illuminated at 360 degrees without the risk of blinding visitors through glare. Photo by Federico Maria Giorgi.

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pecially if the museum is housed in a historic building, dealing with the problems of integrating lighting fixtures and illumination systems in monumental and often protected spaces of our past. This attention to the preservation of monuments shows how the reflection on the role of light inside museum spaces locally developed itself by following various national cultures and customs toward the topic of "care". Through the prism of the attention given to light inside exhibition designs, it is, after all, possible to read much of the critical evolution that has characterised the social objectives and design priorities of Italian and, more generally, European museums: the relationship between collections and space - basically between container and content; the role offered to masterpieces concerning public enjoyment in a kind of perceptive hierarchy; the double scale of environment and detail in the lighting of exhibition spaces; the difficult dialogue between aesthetics and didactics.

Exhibitions and museums have been an emerging topic in the Italian critical and architectural debate since the years of the Second World War: for example, in 1941, the magazine Costruzioni Casabella published a monographic issue examining installations created between 1925 and 1940, considering them as a testimony of the contemporary architectural reflection.[14] During the post-war years, museology and museography not only took note of the fundamental importance of light

Fig. 2: Illumination of the Musée d'histoire de Nantes, in june 2024. In this one example, we can observe different functions of light care: facilitating the reading of printed elements, facilitating the reading of a three-dimensional element through grazing light, and highlighting architectural elements made less visible by the building's restoration work. Photo by Federico Maria Giorgi.

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but also explored it through the now-famous installations of great masters of architecture such as the BBPR, Carlo Scarpa, Franco Albini and many others. In Italy, more than 150 museums were reopened to the public between 1945 and 1953, and about as many in the following decade. Those were times of significant architectural commitment towards the reconstruction of buildings and museums damaged by bombings: the museum and its lighting became important case studies for contemporary architecture as a whole. This "conquest" of the museum by architects and its consideration as a space for high-design experimentation was one of the great novelties of those years, in which Italy was trying to catch up with the backwardness it had developed to the rest of Europe over more than twenty years.[15]

Between 1946 and 1950, for example, the Pinacoteca di Brera was rebuilt after being heavily damaged during the bombardments: the collaboration between the complementary competencies of the famous directors Ettore Modigliani and Fernanda Wittgens, of architecture masters Piero Portaluppi and Franco Albini, but also of illumination specialist[16] allowed the realisation of spaces in which the dimension of the "suggestion", as Fernanda Wittgens defined it, began to assume a central role in introducing the importance of the emotional participation of the publics. 1953 was undoubtedly a particularly rich year for Italian museums: in the Antonello da Messina exhibition realised by Carlo Scarpa, the architect's search for the most appropriate light for Antonello's paintings led him to the very famous solution of vertiginous pleated fabrics that covered the rooms and reconfigured their spatial character. A design proposal that constituted an unprecedented way to screen the natural light entering the rooms but also realised an impressive poetic element in the installation.

In the meantime, Palazzo Bianco had been reopened in Genoa (in 1950); Franco Albini had illuminated its rooms, which had been heavily damaged during the war, with a mix of natural light and artificial lighting: the arrangement of the lamps in the rooms, created employing suspended tracks, was considered an "almost metaphysical element, in which the visitors were invited to enter into a direct relationship with the work of art".[17] Albini's design practice was also reflected in his university teaching; in his lecture for the opening of the IUAV academic year 1954,[18] the master argued that air and light were in their own rights materials for the construction of space and that the technical dimension of lighting had to be considered as a priority in architectural design, especially in that 'exhibition design' which had yet to be defined.[19] The synthesis of its various design components, from display cases to communication and lighting, made exhibition design a field in which Italian architecture has particularly distinguished itself thanks to historical installations, with exemplary exhibitions created by masters such as Carlo Scarpa, Franco Albini, Franco Minissi, but also Pier Giacomo Castiglioni or Marcello Nizzoli, right up to contemporary installations such as those made by the Migliore-Servetto studio.

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From conservation to communication: artifical lights at the origins of the debate on "care"

The post-war years were also the time when great attention began to be given to the overall lighting of spaces and the light inside individual showcases. As such, lighting would take part in the more general debate on the relationship between the public's experience and the masterpieces: for example, from the Central Institute for Restoration came the proposal to direct and concentrate light, and thus the public's interest, on the highest quality works, leaving the rest of the collections in diffuse light.[20] Theoretical elaborations on the incidence, colour and intensity of light and new exhibition practice also began to move museums away from the undifferentiated penumbra in which many collections had been previously confined. They followed, on the one hand, the public's need for a perfect view of the work and, on the other, the new awareness of the value of atmosphere and emotion for the experience of art.

From this perspective, the post-war democratic focus on the educational role of cultural institutions in advancing civil progress also corresponded to an extension of museums' opening hours late into the evening[21] to allow workers to access exhibition halls. Analysing the role and importance of artificial light became mandatory for controlling the harmony between artificial and natural light while facilitating the comprehension of the collections for an ever-larger audience of non-specialists.

A handful of articles in the *Bollettino d'arte*, *a* magazine published by the Ministero della Educazione Nazionale - direzione delle Antichità e Belle Arti, are still an essential testimony to the contemporary genesis of a conscious consideration of the use of light for the physical and psychological well-being of visitors and the proper conservation of exhibits' objects.[22] Piero Sanpaolesi (1904-1980), both an architect and an architecture historian, was one of the protagonists of the culture of restoration in the second half of the 20th century, Soprintendente ai Monumenti e alle Gallerie in the cities of Pisa, Livorno, Lucca and Massa Carrara from 1943.[23] In 1949, he published '*Tipi di lucernari per illuminazione*', which was inspired by solutions he had previously realised in the Museo della Collegiata in Empoli and during the restoration and reconstruction of the former San Matteo Prison in Pisa. In some respects, his reflections on museum lighting can be considered one of the cornerstones of a new museography in Italy. [24] Sanpaolesi Writes:

> *"Too much light offends the visitor and the exhibited object by encouraging reflections from the walls, and especially from the floors. Too little light (the most frequent problem in museums) does not allow everything in the paintings to be seen. However, determining the amount of light required is difficult in theory...It is therefore necessary to use suitably prepared experimentations for each case."*[25]

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The 'light that offends the visitor', whether by its strong presence or absence, is connected to the difficulties of applying theoretical indications within the concrete experience on the field. However, for the author, some general considerations could still be applied:

> *"Traditional window lighting can be effective in small rooms, while overhead lighting is preferred in medium and large rooms."*[26]

These observations are still strongly linked with the architecture's structure and characteristics; space remains the primary constraint that needs to be considered to define the emotions of visitors. It is from these technical expedients that, according to Sampaolesi, a feeling of well-being arises for the visitors, a sensation for which they very rarely identify the cause, i.e. the light, which architects and curators instead consider to be a tool, as fundamental as it is refined, for elaborating the 'narrative' and presentation of the collections:

> *"The result of these expedients may go unnoticed by most, and visitors are often justified in attributing their well-being to a happy coincidence of favourable conditions. But this is not the case for architects and directors of galleries and museums, who cannot ignore these delicate devices of the institutions entrusted to their care and strive to raise their quality by every means possible."*[27]

Here, we are faced with one of the first citations identifying the correct lighting of exhibition halls as a source of spectator well-being; Sanpaolesi's theoretical guidelines would later be taken up in the third edition of the *Manuale dell'Architetto*[28] *in 1962* and would become one of the best-accepted design models[29] in several post-war museums.[30]

Meanwhile, in 1953, Roberto Carità (1913-2008), who had been working at the Soprintendenza Torinese as Ispettore Storico dell'Arte since 1950, was involved by Cesare Brandi in the new venture of the Istituto Centrale per il Restauro. That very year, Carità also wrote a *Nota sull'illuminazione artificiale delle opere d'arte*[31] in the "Bollettino d'Arte". The profile of the author, a humanist and "idealist", was profoundly different from that of Sanpaolesi. Yet, the importance they both claimed for experimentation in the field of optics and their shared interest in museum lighting demonstrate the topicality of these themes. However, Carità's work at the Istituto Centrale per il Restauro and his commitment to the conservation and restoration of works of art is undoubtedly a vital key in understanding his focus on lighting solutions that couldn't pose a danger to some particularly delicate categories of objects, such as antique textiles and drawings. In the pages of the *Bollettino d'Arte*, Carità disapproved of the habitual dependence of museum lighting on architectural structures and asserted the necessity of appropriate artificial lighting for drawings:

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> *"Looking at the artificial light installations in some museums, one doubts that the most important laws of optics regarding illumination have been taken into account. In some cases, the designs appear to have been drawn up in absolute subordination to the architectural forms, for which the light - to achieve the right combination – should not be in servitude but rather in harmony... I do not consider the absence of daylight a disadvantage... not only to gain space but also to eliminate the possibility of prolonged exposure to light, which is very damaging for drawings, while the lamps can be switched off when they are not needed."*[32]

According to Carità, adequate artificial lighting was particularly suitable for exhibition halls set up in historic buildings - a widespread characteristic in the Italian development of museums - for which the windows openings were often more adapted to housing people rather than housing artworks : "... especially in museums housed in older buildings, where good artificial lighting is undoubtedly preferable to bad natural lighting."[33] One of the cases he presented in the Bollettino d'arte is that of the Albertina museum, where the lighting is considered too intense and therefore not adequate for a good conservation of fragile materials:

> *"Intense light is detrimental to conservation: thinking that the intensity is, for our eye, measured in relation to the environment (and this can be clearly seen by projecting slides in a dark room or only in half-light or full light) I thought it appropriate to keep the diffuse lighting in the rooms as low as possible, to make the lighting concentrated on the works more evident."*[34]

Again, on the topic of collections' conservation, Carità observe how even the design of individual display elements could prove harmful to artworks and pose some critical problems:

> *"I have observed that, for the illumination of single works, outdoors or inside a display case, the light source is almost always placed too close and with direct incidence on the object, forgetting that, among the many possibilities of damage to paintings, not the least is discolouration."*[35]

Seventy years later, many of Roberto Carità's technical indications are now obsolete, overtaken by the extraordinary evolution of lighting technology. However, the most interesting and perhaps still influential part of his text remains the one in which the author introduces the theme of the visual 'fatigue' and

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'rest' of the spectator in relation to lighting. Stressing not only the importance of light for the well-being of the audience, Carità explains the importance of an appropriate use of materials and opaque surfaces in exhibition halls by using musical analogies:

> *"The appropriate use of such surfaces is not dictated by reasons of taste, nor by 'feeling' of rest that arises from viewing them. This can be explained by acoustic analogies, as light and sound radiations often follow similar laws. Just as fabrics, by extinguishing echoes, give a 'plush' sensation, so opaque surfaces act towards light. And, again, just as resonances and echoes cause annoyance to a listener of music, so do scattered and unnecessary reflections that reach the eye of the beholder of a work of art: with the difference that a sound disturbance is immediately perceived, while an optical disturbance, within the field of vision but not in the focus of the pupil, is a disturbance that is felt but not immediately explained. The result is fatigue."*[36]

According to Carità, therefore, part of the typical fatigue we feel during museum visits is caused by optical disturbances, perceived but undetected, due to reflections produced by bad lighting and wrong surface materials. Indeed, one of the most modern elements of this discourse, which, let us remember, dates back to the 1950s, lies in the search for the physical and psychological well-being of the spectator and the experimental use of new lighting techniques to achieve an objective which, until recently, was essential-

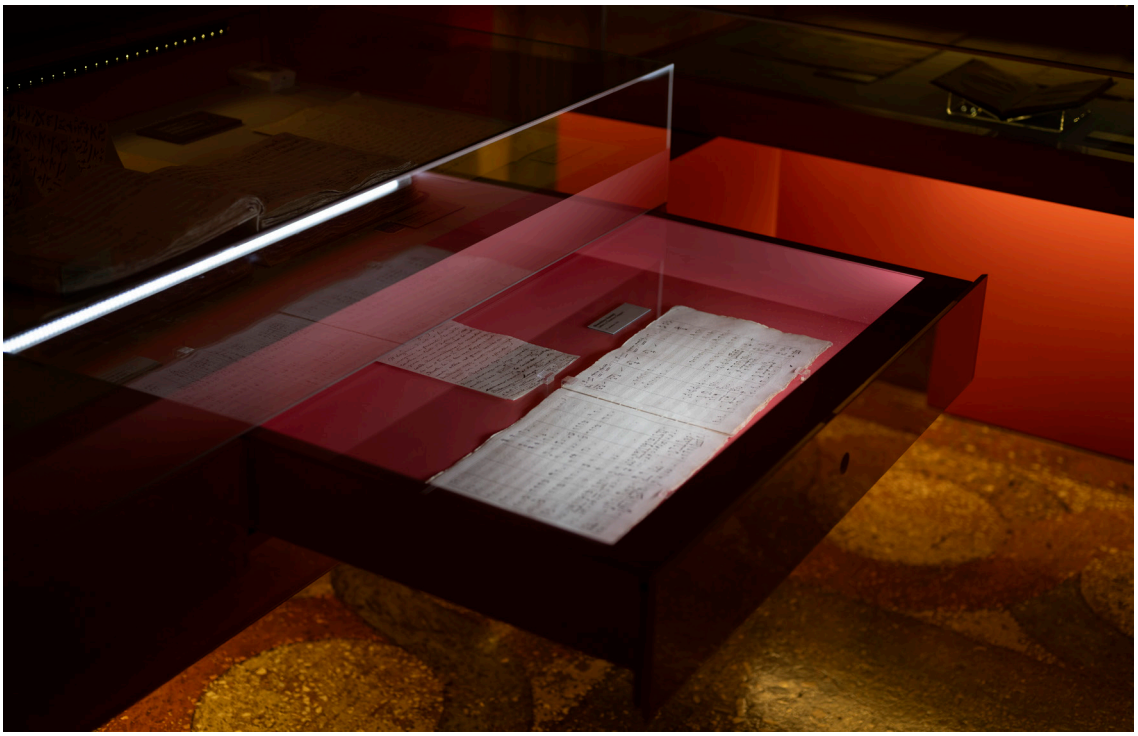

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Fig. 3: Dynamic light system made of movable drawers installed inside the Museo Internazionale e Biblioteca della Musica di Bologna, November 2024. Despite the great technical care that characterises the construction of these display cabinets, the visitor's experience is challenging when this type of protective mechanism is repeated too often, as the action of opening and closing the drawers entails, not only physically but also symbolically, a fragmentation of the visitor's attention. Photo by Federico Maria Giorgi.

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ly foreign to both museum practice and museology. Its great actuality can be seen in some recent reflections on the risk of creating homogeneous and contrasting lighting scenarios inside exposition, as they could, similarly to sudden and irregular changes in music rhythm, cause distress and anxiety in people affected not only by visual handicaps but also by psychic disabilities.[37]

Ambiance and the birth of a new profession: how light-designer changed the horizons of care.

On the 17th of May 1947, ICOM was born, which, although in different ways, throughout its various definitions, would indicate that the objective of museums was "to conserve and exhibit": to follow an oxymoron that wasn't always easy to realise. Franco Albini, for example, was responsible for the realisation of the Treasure Room of San Lorenzo in Genova in 1956, an early and exciting case study for the controversial relationship between lighting and conservation, between the spectator's emotions and the good preservation of works. Here the cases of the precious copes of the Cathedral were initially closed by "luminous hairs" that were later removed because Caterina Mercenaro didn't like them and were never restored because they contained neon tubes that would prove contrary to the good preservation of ancient fabrics[38] in the years following Albini's realisation. The fundamental debate between conservation and atmosphere that was to characterise the whole of the second half of the 20th century on the correct use of light in museums and exhibitions is already evident here.

The Castelvecchio museum in Verona, which was opened in 1964, is further proof of this: Carlo Scarpa's installation is considered as a whole to be one of the great masterpieces of second-century museography. However, the lighting system, although particularly elegant and attentive to the building's historical pre-existences, is today - at least according to Paola Marini, former director of the museum - the aspect that has become most obsolete over the years.[39] Perhaps because it cannot create the intensely emotional atmospheres that the general public now demands for exhibitions and museums.[40] In May 2024, during a short presentation for the conference "*Architettura disciplina eteronoma*", James Bradburne highlighted how, during his time at the Pinacoteca di Brera as a director, the decision to change the light-design of the entire museum radically from its previous homogenous illumination was due to the necessity to engage more effectively the public with stronger contrast between light and shadow.[41]

It seems clear that the recent rise of both temporary exhibitions and new artificial lighting technologies has led to the emergence of a new profession of "artisans" who are making collections increasingly spectacular, perhaps for some overly so, and whose expertise combines both theatrical and scenographic knowledge to enhance the experience of visitors and spectators: light designers. The foundation of the International Association of Lighting Designers (IALD)[42] in 1969 can be considered as the birth of this new

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specialised branch of professionals that were coming from a broad range of studies and experiences[43] but was also a great occasion for the circulation and dissemination of knowledge on the topic of illumination.[44] Since then, a semiotic of illumination has developed between these experts, a grammar of light's parameters and variables that can give new meaning to an exposition through common historically superposed assonances.

Recent examples of effective use of the "grammar of light" have tried to create or even recreate an ambience. One example is the light design project for the exposition *Hogarth, Reynolds, Turner. Pittura inglese verso la modernità* that was opened at the Museo Fondazione Roma from the 15th of april to the 20th of july 2014. The light designer recreated the impression of a space illuminated with candlelight[45] using modern technologies while at the same time guaranteeing the visual comfort of the visitors. Giuseppe Mestrangelo gives us the following insight on this project:

> *"The exhibition path was to be characterised by imitating the light, just right for the most likely setting of the period presented in the project's stage setting. It was not necessary to have chandeliers or appliqués, just the artificial luminous flow of light "managed knowledgeably" in composition, giving visitors the real sensation that they were in a place lit up by candles."*[46]

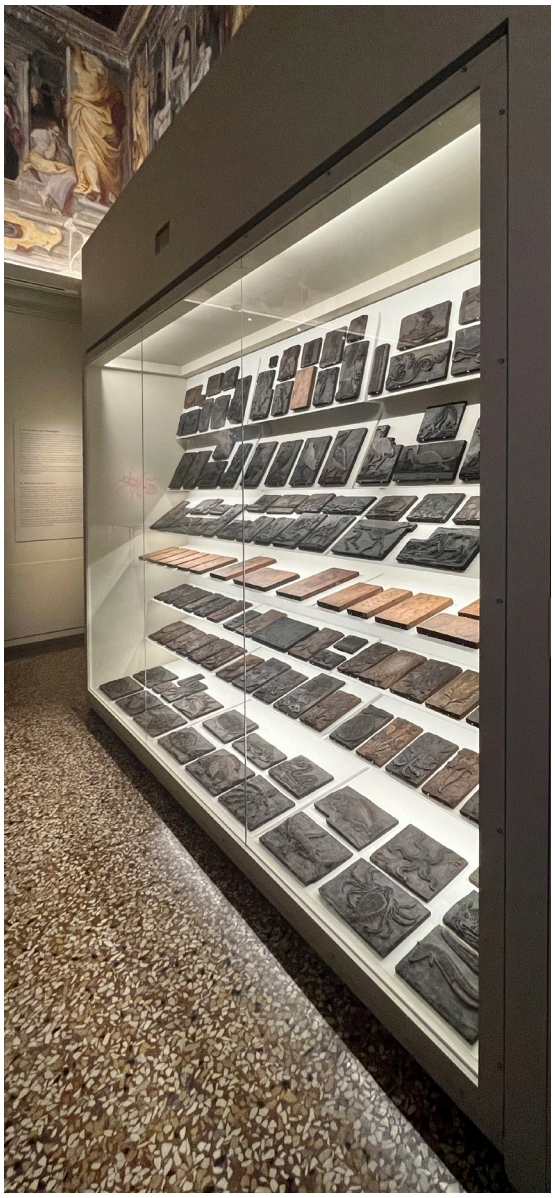

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Fig. 4: Illumination of the exposition *Ulisse Aldrovandi, l'Altro Rinascimento* in Palazzo Poggi, Bologna. This example clearly shows how the objective of facilitating the visual experience of visitors with light can also be achieved through inexpensive technical solutions that do not necessarily require special or expensive lighting equipment. In this case, simple LED strips and slanted wooden panels allow a good view of embossed objects. Photo by Federico Maria Giorgi.

Recently, Andrea Graser also highlighted the possibilities that modern lighting offers to museums as a way to transport visitors to the original context of the artwork:

> *"Just as it is possible to digitally scan an object, a room or a building and then plot it in a three-dimensional model, it is also possible to measure the light at a specific location using a digital spectrometer, store the data and*

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> *reproduce it in a new environment using state of the art lighting technology. Taking this concept further, one might use a digitally controlled dynamic lighting system to travel in time – for example, from the light of the present day to that of the Baroque – or to transport the light of Central Europe to the light of the North or South."*[47]

Since the late 20th century and with the emergence of these new tools, lighting designers have been asked to create immersive experiences for visitors in environments that should encourage discovery, curiosity and learning by orienting and guiding audiences while at the same time helping to preserve the works and objects on display. In 2004, the Commission Internationale de l'Éclairage (CIE) fixed a series of thresholds for the preservation of museum objects[48] that, despite not being radically different from previous research, were calculated on an annual basis, allowing curators to modify the amount of light in the function of the various needs of the moment. For example, works could be exposed for the duration of an exposition to a more impactful source of light and then put to "rest" for the rest of the year, or light sources could be automated to dim in relationship with the movement of visitors or with the change of natural light. Dynamic lighting offers more room for the creativity of light designers to shine and more opportunities to integrate the care of the artworks with the care of the visitors; stronger illumination settings could, for example, be prepared for the guided visits of people with visual impairments. Another possibility offered by dynamic artificial light is to simulate the natural daylight and its evolution throughout the day-cycle. For example, since 2019, Veronika Mayerböck has replaced the fluorescent tubes of the Kunsthistoriches Museum's glass ceilings with LED in her design in order to simulate the daylight that once entered the museum through the now veilled skylights.[49] This solution could prove particularly interesting for the topic of care as various scientific studies have shown the lasting effects that artificially simulated daylight systems can have on people's health and well-being.[50] The emergence of LED technologies is also at the centre of significant advances in the scientific field of psychology and perception. The fully customisable nature of LED sources, in colour and intensity, allowed researchers to engage in new studies aimed toward analysing our psychological reaction to different lightning situations.[51] The international lighting magazine *Luminous* produced a special 'Light Health and Wellbeing' issue in 2010 where French light designer and specialist of 'éclairages durables'[52] Vincent Laganier wrote: "By asking who the users are, what they do, and how they will use the buildings, lighting designers can contribute to their happiness and health".[53]

This indication seems even more relevant for museums that are called upon to increasingly assume a repairing function in which the "care" of the public has become an essential element of any up-to-date

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Fig. 5: Illumination of the exposition *Ulisse Aldrovandi, l'Altro Rinascimento* in Palazzo Poggi, Bologna. The light of the immersive video projected on the ceiling of this room completely changes the perception of the room. Although viewing some works from the museum's permanent exhibition is more complex, the experience and atmosphere of the visit are completely changed for the duration of a temporary exhibition simply through light. Photo by Federico Maria Giorgi.

museographic discourse. In certain peculiar occasions, this sense of care can be extended not only to the visitors but also to the artists themselves and their vision. Often, a dialogue between living artists and light designers is necessary to better integrate their artwork inside the exhibition spaces and as a way to improve their trust.[54] This attention to the artwork's characteristics can also give voice to new interpretations and discoveries by highlighting small details that would otherwise remain unseen. This is why Vivianna Gobbato observes how light could if used correctly, become a temporary and reversible tool of restoration:

> *"By a gesture that can be erased, illumination contributes to a form of aesthetic renovation of the works. This gesture admits a dimension of perceptible and formal transformation of the work in the*

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> *museum. The light reveals a completely different facet of the object previously known from one angle. Such a dimension makes lighting a tool capable of orienting and modifying the perception of an institutionalised object, but also able of establishing it as part of our heritage."*[55]

In recent years, the technical achievements, the evolution and specialisation of lightning solutions for museum displays have also taken a new importance of their own, often inspired by the equipment of theatrical and film sets they have, however, to answer the challenge of a moving public. As such, light emitters cannot always be hidden, and therefore, their design is the object of careful studies that have even been awarded important titles like the Compasso d'Oro: the "Shuttle" projector series designed by Bruno Gecchelin and produced by iGuzzini Illuminazione was awarded in 1989, while the "Mondial F1" modular system designed by Paolo Targetti and produced by Targetti Sankey received the prestigious award in 1998. In the jury motivation for both prices, we can underline the importance for illuminotechnic devices to easily "integrate into different spaces" and "to answer to multiple requisites";[56] in short it must be flexible and beautiful.

Today, lighting designers are called upon to compose and coordinate different technical requirements that are no longer just architectural but concern both the priorities of conservation of the works and the well-being of the spectators as well as short and long-term economic, organisational and sustainability needs linked to the exhibition design. From a technical point of view, new importance is, of course, given to the energetical efficiency of light fixtures inside museum spaces, mainly with the help of LED technologies and automation strategies. However, even simple tools such as mirrors have been reinterpreted to answer the new challenges of "energetical care". In the Museo Internazionale e Biblioteca della Musica of Bologna, Light Design Studio installed a complex chandelier,[57] which reflects the light coming from a single light source in different directions, thus cutting down on the energy and materials necessary to illuminate the numerous objects present in the room.

The strategic pursuit of EVC (efficient visual comfort) - in which conservation, enjoyment, and sustainability come together for the benefit of collections, viewers, and now the planet- incorporates a new design horizon destined to become increasingly important. As such, the illumination of the museum seems to be destined to remain at the centre of the complex overlap that characterises our newfound vision of sustainable care: one that balances the conservation of artworks and spaces, the economic attractiveness of the museum and its sustainability, and the well being of the publics.

Conclusion

The use of light as a vector for care has been for a long time at the centre of a complex balancing act between different objectives: protecting artwork, providing good visibility, ensuring the comfort of visitors, val-

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orising exposition space, creating atmospheres and the reducing museums' energy consumption. Nowadays, the technological progress linked with both the physical light sources and their digital controls allows us to easily find this difficult balance and allows us to focus our attention on innovative solutions that give voice to the technical and artistic capabilities of a new type of professionals.

However, the career and life path that leed to this kind of expertise are still very diversified inside the European context, and it's difficult to define a common base of knowledge for this kind of profession that keeps, to this day, an artisanal and hand-made approach. At the same time, other museum professionals still lack the technical knowledge necessary to effectively communicate on the critical challenges surrounding the topic of light management.

In this perspective, future generations of architects, light designers, and curators should strive not only for the dissemination of knowledge between different fields of studies but also for the sensitisation of the museums' public to these topics. Highlighting the technical aspects that influence the decisions made "behind the scene" to a broader audience could prove beneficial in giving "new light" to the topic of museums' light design, by making what's often invisible to the audience visible again.

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Endnotes

1 See, for example, the following: "… this roof-lit room, which puts the paintings in their most advantageous light, has been gratefully accepted.", Jean Baptiste Pierre Lebrun, *Avertissement*, Paris, 1789, cited in : Lemaire 2004, p. 63. Translation by the author, original text : "… cette salle éclairée par le comble, et qui met les tableaux dans leur jour le plus avantageux, a été acceptée avec reconnaissance."

2 By the end of the century Jean-Nicolas-Louis Durand was advocating for this kind of natural lighting solution in an architectural manual: *Précis des leçons d'architecture données à l'École Polytechnique, par J.-N.-L. Durand*. See Durand 1802 p.112.

3 We can highlight the reflections made by Julien Guadet at the turn of the century, where he expressed how lightning solutions should be chosen in function of the museum typology: high windows to protect against the reflected glare of glass displays and to underline the forms of sculptures; roof windows for paintings. See Guadet 1901, p. 613.

4 See also Gobbato 2021, pp. 24-36.

5 On this topic see for example: Bianchi, Pulcini 1995; Forcolini, 2012; Vivioli, Galati 2014.

6 Before the second world war, Jean Fernand Cellerier, director of the Laboratoire d'essais du Conservatoire national des Arts et Métiers, already defined the maximum quantities of light that could be applied to different materials and works of arts. See Cellerier 1931, p. 69.

7 While strongly criticised for over-dramatising artworks, Ned Burns was at the time inspired by the illumination practices of cinema and theatre to propose the installation of coloured gelatine strips onto small light spots to accentuate certain areas of an artwork, for exemple, amber colours for shadows, green for foliage during the day, blue for foliage during the night and pale shades of blue for snowy landscape. See Burns 1933, p.126.

8 Sociètè des Nations, Office International des Musées, Istitut Internazional de Coopération Intellectuelle 1934.

9 In between the two world wars, what can be considered the press organ of the International Office of Museums, *Mouseion*, had been, as we highlighted before, an essential place for the birth of an early debate on the complex and often contrasting roles of light inside museums.

10 Vienot, Durand, Mahler 2009.

11 James Druzik is a senior scientist at the Getty Conservation Institute. Bent Eshøj is the director of the School of Conservation at the Royal Danish Academy of Fine Arts.

12 Druzik, Eshøj 2007, pp. 51-56. See also: https://www.academia.edu/8308202/La_luce_nello_spazio_del_museo_significati_e_prospettive_per_una_valorizzazione_del_patrimonio.

13 See: https://www.academia.edu/8308202/La_luce_nello_spazio_del_museo_significati_e_prospettive_per_una_valorizzazione_del_patrimonio.

14 See Curzi 2022, p. 16.

15 See Morello 1997, p. 392.

16 In this regard, Marco Semenza and G.A. Rigatti should be mentioned, see De Simone, Modesti 2022, p. 210.

17 Curzi 2022, p. 22.

18 The lesson was later published in Casabella, n. 230, February 2005, p. 9-12,

19 Curzi 2022, p. 19. See also Bucci 2016.

20 Carità 1953, pp. 357-364. See also De Simone, Modesti 2022, p. 218.

21 The Paestum Museum designed by architect Marcello De Vita was inaugurated in 1952. See Sestrieri 1953, p. 182. Cited by De Simone, Modesti 2022, p. 219.

22 Sanpaolesi 1949; Carità 1953. See also De Simone, Modesti 2022, p. 218.

23 During his work, Sanpaolesi also dealt with the reorganisation of local and peripheral museums, leading to the best-known experiences of the Museo Nazionale di San Matteo in Pisa, the Museo Nazionale di Villa Guinigi in Lucca and the reorganisation project of the Galleria Sabauda in Turin. See Spinosa 2007.

24 In the article, the graphs are complemented by a precise technical explanation and a study of daylight incidence and diffusion. See Sanpaolesi 1949, pp. 280-283. See also Consiglio Nazionale delle Ricerche 1962, p. 360; Spinosa 2007.

25 Sanpaolesi 1949, p. 280. Translation by the author: “Troppa luce offende il visitatore e gli oggetti esposti favorendo i riflessi dalle pareti e soprattutto dai pavimenti. Poca luce (è il più frequente difetto dei musei) non consente di vedere tutto nei dipinti. Però una determinazione della quantità di luce necessaria è difficile in via teorica...È necessario quindi valersi, caso per caso, di esperienze opportunamente predisposte.”

26 Sanpaolesi 1949, p. 280. Translation by the author: “Per le piccole sale quindi si può con ottimo risultato mantenere la tradizionale illuminazione con finestre, mentre per le sale medie e grandi si adotta preferibilmente l'illuminazione dall'alto.”

27 Sanpaolesi 1949, p. 282. Translation by the author: “Il risultato di questi accorgimenti può passare forse inosservato ai più, e i visitatori sono anche autorizzati ad attribuire il benessere che ad essi ne viene ad un felice casuale combinarsi di favorevoli concomitanze; ma così non è per gli architetti e i direttori di pinacoteche o musei, che non possono ignorare questi delicati congegni dell'organismo loro affidato, e con ogni mezzo cercare di elevarne la qualità.”

28 Consiglio Nazionale delle Ricerche 1962.

29 The skylight solution was also adopted in those years in the *Sala dei primitivi* of the Galleria degli Uffizi in Florence, set up by Scarpa, Gardella and Michelucci between 1953 and 1955. See Curzi 2022, p. 21.

30 Take, for example, the Museo di Capodimonte finished between 1952 and 1957, thanks to Bruno Molajoli and Ezio Bruno De Felice. See De Felice 1979, p. 45.

31 Carità would later become Soprintendente of Sassari and Nuoro from 1960 to 1973.

32 Carità 1953, p. 357, 359. Translation by the author: “Osservando gli impianti di luce artificiale di qualche museo, vien fatto di dubitare che si siano tenute presenti le più importanti leggi che l'ottica ha enunciato nei riguardi dell'illuminazione. In alcuni casi, i progetti appaiono elaborati in dipendenza assoluta delle forme architettoniche, rispetto alle quali la luce - per attuare un giusto connubio - deve essere non in schiavitù, ma in armonia... Non considero uno svantaggio l'assenza di illuminazione diurna... non solo per guadagnare spazio ma anche per eliminare la possibilità di una prolungata esposizione alla luce, che è molto dannosa ai disegni, mentre le lampade possono essere spente quando non servono”.

33 Carità 1953, p. 359. Translation by the author: “...specie nei musei sistemati in palazzi antichi, ove una buona illuminazione artificiale è da preferire, senza dubbio alcuno, ad una cattiva illuminazione naturale”.

34 Carità 1953, p. 359. Translation by the author: “l'intensa luce è dannosa alla conservazione: così, pensando che l'intensità è, per il nostro occhio, una misura anche in relazione all'ambiente (e ben lo si nota proiettando diapositive in una camera buia o soltanto in penombra o in piena luce) ho ritenuto opportuno tenere al grado più basso possibile l'illuminazione diffusa nelle salette, per rendere più evidente l'illuminazione concentrata sulle opere.”

35 Carità 1953, p. 363. Translation by the author: “Ho osservato che, per l'illuminazione di opere singole, all'aperto o in vetrina, la sorgente di luce è collocata, quasi sempre, troppo vicina e con diretta incidenza sull'oggetto, dimenticando che, fra le tante possibilità di danno che incombono sui dipinti, non ultima è la decolorazione.”

36 Carità 1953, p. 359. Translation by the author: “L'opportunità di tali superfici non è dettata da motivi di gusto, ne ‘sentimento’ il senso di riposo che nasce dalla visione di esse. Se ne possono spiegare le cause ricorrendo ad analogie acustiche, poiché le radiazioni luminose e quelle sonore seguono spesso leggi simili. Come le stoffe, spegnendo gli echi, danno una sensazione ‘felpata’, così le superfici opache agiscono nei riguardi della luce. E, ancora, come generano fastidio le risonanze e gli echi a chi ascolti una musica, così recano disturbo i riflessi dispersi ed inutili che giungono all'occhio di chi osserva un'opera d'arte: con la differenza che un disturbo sonoro è immediatamente avvertito, mentre un disturbo ottico, compreso nel campo visivo ma non nel fuoco della pupilla, è un disturbo sentito ma non immediatamente spiegato. Risultato è la stanchezza.”

37 This peculiar point was highlighted by Catherine André, deputy to the head of the education and culture department for mediation projects of the Petit Palais, during the Séance 7 of the Diplôme d'université Delphine Lévy. Pour l'accès à l'art et au patrimoine : outils et recherches, “*Accessibilité universelle et musée inclusive*”, that was hosted by the Petit Palais in Paris on the 1st of December 2023.

38 Musso 2022, p. 58.

39 Marini 2022, p. 88.

40 Today’s museums, and especially their temporary expositions, are in concurrence with other industries for culture and entertainment; they need to be more exciting and dramatic, which is often possible with light.

41 On this occasion, Bradburn Cited the text “In Praise of Shadows” by Jun'ichirō Tanizaki to underline how without shadows we forget the importance of light, and that good lighting cannot be made visible without good shadows.

42 The association is still active today: www.iald.org.

43 A divergence in experiences, often made more apparent by different national educational systems, is leading to the quick formation of various local traditions and habits that come from the sensibilities learned from a multitude of career paths. A diversity in perspective that as strongly expanded the horizons of the relationship between light and ‘care’. This difference in study paths between nations is also probably one of the many reasons for today’s broad cultural landscape on the topic of light and for the drastically different usage and habits worldwide.

44 See also: Illuminating Engeneering Society of North America 1996.

45 Andrea Graser observes on this topic how: “Light has the potential to be sensed as a space. A streetlight, for example, is perceived as a cone of light in the darkness”; Graser 2023, p.29.

46 Mestrangelo 2017, p. 81.

47 Graser 2023, p.11.

48 See also CIE 2004.

49 Graser 2023, p. 45.

50 Many researchers demonstrated that the Human Centric Light system can positively impact the well-being of employees and reduce the number of sick days inside offices or improve the buying habits of customers inside retail structures. See for example: Kyle Konis, 2019.

51 See for example: Veitch 2001.

52 Laganier, Van Der Pol 2011.

53 Laganier 2010. Translation by the author: “Chiedendosi chi siano gli utenti, che cosa fanno e come utilizzeranno gli edifici, i progettisti dell'illuminazione possono contribuire alla loro felicità e alla loro salute”.

54 Gobbato 2024, pp. 71-73.

55 Gobbato 2024, pp. 135-136. Translation by the author, original text: “Par un geste effaçable, l’éclairage participe d’une forme de restauration ésthétique des œuvres. Ce geste admet une dimension de transformation perceptible et formelle de l’œuvre au musée. L’objet auparavant connu sous une facette dévoile sous la lumière un tout autre visage. Une telle dimension assimile l’éclairage à un outil capable d’orienter et de modifier la perception, mais aussi à la patrimonialisation de l’objet institutionalisé”.

56 Informations regarding the design awarded with the Compasso d’Oro can be found on the site of the ADI Design Museum - Compasso d’Oro: https://www.adidesignmuseum.org/schede/shuttle/; https://www.adidesignmuseum.org/schede/mondial-f1/.

57 The Multireflex light system, developed by Anniluce, can illuminate a space by exploiting just two high-yield, low-consumption light sources that are reflected downward by 31 mirrors divided in two rows. See: https://www.annilucebylightstudio.it/multireflex-detail.

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