Expographic Lighting in Reused buildings, a Preliminary Assessment of Three Museums in Algiers

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ABSTRACT

The city of Algiers comprises eight museums, more than half of them are reused buildings. In this paper, we are interested in the museographic lighting requirements in reused buildings that haven’t been initially designed for expographic purpose. The conversion of buildings into museums may have some constraints. Natural light is an important constraint whose modeling depends on formal, structural and spatial characteristics of the building. And supplying with artificial lighting depends largely on it, thereby having direct repercussions on energy consumption. Conversion of historic buildings, in itself exhibition subjects, can also reduce adaptive space possibilities to museographic lighting requirements. This paper is the synthesis of a master preliminary study where we attempt to assess the exhibition’s lighting quality in three reused buildings, based on blueprints (metric supports), the author’s observation and photographic supports. This preliminary assessment is aimed to evaluate the case studies through literature recommendations of “accent” and “ambient” lightings in exhibition spaces. Despite the constraints related to the conversion of a building into a museum and the importance of lighting design in expographic quality, it may be possible to ensure a lighting quality by adapting the collection types to the space opportunities especially related to natural light. The heavy architectural structures present more constraints than light architectural structures, limiting exposition to permanent collections, especially 3D artworks with consequent dimensions that are the best recommended with natural lateral lighting. Oppositely, the light architectural structures induce flexible and big spaces that seem to be the best adapted to temporary collections especially when offering natural zenithal lighting for “ambient” requirements.

INTRODUCTION

Exhibitions, representing places of themes, interaction, communication and entertainment, are available in a wide range of types, varying according to the theme, content, temporality, scenography and the space housing the exhibition. Museums, being the warehouse of our tangible cultural heritage, represent the largest exhibition venues [1]. Museum culture in Algiers tends to be developed through various activities that take place in the institutions of the capital, and whose number is increasing. This has in part led to the conversion of a number of buildings into museums to host this kind of cultural events. The quality of a museum exhibition is conditioned by a number of requirements related to visitors comfort, artworks conservation, and to the exhibition space itself. It is through these requirements that “lighting” is raised as a predominant factor [2]. In this work, the interest is focused on expographic lighting, especially on two of its components, which are “ambient” and "accent" lighting. The third being the “orientation” lighting that has a very little influence on modeling space and appearance of the exhibited artworks. The expographic lighting is provided by the combination of natural and artificial lighting that depends on some parameters: temporality (with exhibits that may be permanent or temporary), the type of collections on display (2D or 3D objects), and the space housing the exhibition. If the natural lighting is yet a challenge that has to be met in the first phases of the design
process, because its management and modeling depend entirely on the formal, structural and spatial characteristics of the building, that influence the distribution of illuminance, luminance ratios, and the perception of light, what to say about the building converted to host a museal exhibition that involves considerable constraints, inducing an important supply of artificial lighting with considerable energy consumption [3, 4]. In this paper, we attempt to raise the qualitative aspect of museum lighting through some recommendations issued from a preliminary assessment of three case studies. These recommendations could help the architect to integrate lighting feature in upstream of his reflection in the design of a museum or conversion of a building into a museum.

**MUSEOGRAPHIC LIGHTING REQUIREMENTS**

**Combined lighting**

The perception of the exhibition, the visitor intuitive orientation and quality of environments are a central concern in a museum space. A suitable level of lighting must meet the requirements of the conservation works and facilitate the adaptation of visitors to the area, while distinguishing each space from another, etc [5]. The museum lighting is defined as an underlying factor in exhibition quality, and is declined in different types, but the focus in this paper is on its role of expression element through expographic lighting, as “ambient”, and “accent” lighting. “Accent” lighting helps to highlight the exhibits and the architecture, and to emphasize their various components and characteristics. This induces the creation of a hierarchy in perception, depending where attention must be captured [6, 7].

“Accent” lighting is designed for numerous purposes such as differentiating objects or artwork through various levels of illumination, or more precisely to model sculptures, etc [7, 8]. While “Ambient” lighting is generally a diffused lighting designed primarily to show the proportions in a space and the limits of a room. It provides the space a general brightness that facilitates the observation of displayed artworks, as well as showcasing the space itself [2]. So, we can admit that museum lighting is a secondary language, meeting the criteria of a semiotic system as its other elements, resulting in the interaction between space, object and visitor [9]. With all these considerations, the expographic lighting depends largely on the exhibition theme and the expected impression and emotion to provoke. Concerning the conversion of a “historic” building into a museum, the expography has to embrace the space, avoiding any additional structure that might affect the building itself as an authentic “heritage”.

**Natural lighting**

Advances in artificial lighting tend to reduce the importance of natural lighting in architecture, and so in the exhibition spaces. But improving the architectural experience, ensuring greater satisfaction through the artwork appreciation, connecting the visitor with the outside, ensuring a positive psychological impact, and reducing the energy consumption; are all reasons that encourage the integration of natural light in exhibition spaces [3, 10, 11, 12, 13]. Natural light is assured by different device typologies—with various characteristics and effects, such as lateral lighting device, zenithal lighting device and polar oriented skylight [8]. Concerning the “ambient” expographic light, configuration and characteristics of the space play an important role, because the space’s height and surface, the proportions of openings, and so on, determine its ambience. Soft diffused light is generally considered as a leading “ambient” lighting element. For the “accent” lighting, zenithal and polar oriented devices are the most recommended for lighting two-dimensional subjects (2D) and present the best compromise for daylighting a flexible space hosting temporary exhibitions, preventing direct sunlight from penetration and overcoming the reflection that causes glares. While the lateral lighting device is the most constraining for 2D artworks and particularly for temporary exhibitions, it is better suited to permanent exhibitions composed of 3D objects due to the shading patterns generated by the luminous flux.
In the following table are summarized the literature recommendations about expographic natural lighting devices that we classified into four ascendant degrees of quality: “less recommended”, “just recommended”, “well recommended” and “highly recommended”. [Tab.1]

Table 1. Natural expographic lighting recommendations

<table>
<thead>
<tr>
<th>Natural lighting</th>
<th>Ambient</th>
<th>Accent</th>
<th>2D</th>
<th>3D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral</td>
<td>Less Rec,</td>
<td>Just Rec.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polar Oriented skylight</td>
<td>Highly Rec.</td>
<td>Well Rec.</td>
<td></td>
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</tr>
</tbody>
</table>

Rec. = Recommended

The openings type plays an important role in the exploitation of exhibition space; so it is recommended to optimize the exhibition surface by minimizing the openings surface. A well-designed natural lighting strategy could direct visual accent to the display without glare surface at modest levels of lighting. In this context, the electrical lighting loads can be reduced and compensated by the natural light, instead of an increase in competition with excess of clarity [8]. The objectives of natural lighting exploitation in the exhibition spaces consists in maximizing the light source by using its features and eliminating its defects and drawbacks. This is done by considering parameters and requirements related to the space, the exhibits sensitivity, as well as the visitors’ comfort [9, 11]. And so, natural lighting should be considered before each exhibition program for both conservation and exhibition requirements. Its expertise generally supported by detailed graphics on devices and openings, should be perfected by an experimental computer modeling showing the lighting comportment [2, 11].

Artificial lighting

Unlike natural lighting, the peculiarities of artificial lighting are precision in controlling the direction and amount of light used, as well as the constancy (regularity) [8]. The exhibition spaces are therefore not subject to seasonal or diurnal variations, contrary to natural light, but characterized by stability and adapted control, more suitable to the standards of artworks conservation. For the temporary exhibitions characterized by a short time visit in a museum, the flexible lighting is the most recommended, which only the artificial lighting could offer, through focused rail systems, rotary and swivel spots, etc. [4]. Artificial source typologies are classified according to their distribution of light, and there are three main types. Firstly, the “direct light” which can be diffused, focused or framed. The “direct diffused light” gives the background a significant importance by uniting it to the exhibit, while a “direct focused lighting” narrows it. “The direct framed lighting” decontextualizes subjects through the contrast it creates—and therefore allows the reduction of the illumination. Secondly, the “Indirect lighting” and finally the “direct/indirect lighting”. [4]. [Tab. 2]

Table 2. Artificial expographic lighting recommendations

<table>
<thead>
<tr>
<th>Artificial lighting</th>
<th>Ambient</th>
<th>Accent</th>
<th>2D</th>
<th>3D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Framed</td>
<td>Highly Rec.</td>
<td>Less Rec.</td>
<td>Just Rec</td>
<td>Just Rec</td>
</tr>
</tbody>
</table>

Rec. = Recommended / ¹ For dramatic ambiances / ² For soft ambiances
One of the main concerns of artificial lighting is energy consumption. Each project must have accurate energy balance and where possible, a comparison with the previous installation. In addition to this assessment, it is recommended to use low-consumption lamps, such as LED or compact fluorescent lamps [14]. The use of motion sensor or timer which could improve the conditions of artworks conservation is also recommended for energy economy [14]. In theoretical view, natural light should be considered as the main source of expographic lighting and artificial lighting should be considered as a complement, to bear deficits or to meet the conditions of conservation works. Even if all the criteria cited above, are difficult to combine in a museum, they must be carefully stated and considered for best expographic lighting quality [2].

METHODOLOGY

Case studies

The Museum of Modern Art of Algiers

The museum of modern and contemporary art in Algiers, called MAMA (Musée d’Art Moderne d’Alger), was inaugurated in 2008. It is the first major commercial structure devoted to the cultural sector and the first conversion operation of an old colonial monument of such importance (Fig. 1a). The museum is currently entirely devoted to temporary exhibitions and hosts 2D and 3D artworks. The building is constructed on five floors, including a basement arranged as a Central Exhibition space (atrium) and the exhibition galleries are arranged around the atrium on the different floors (Fig. 1b,c). With a natural light structure, it has three glassed domes, surrounded by small skylights, shaped like stars (Fig. 1c). A staircase initially centered in the atrium has been removed during the building conversion to offer the museum more flexibility in terms of planning.

The national Museum of Folk Arts and Traditions

The historic Palace where are kept the ethnographic collections of the Museum of Arts and Popular Traditions was built in 1570 by the Ottomans. Located in the old city, it became a museum of popular arts and traditions in 1961 after the acquisition of a permanent collection that includes around two-thousand objects related to crafts and other popular arts, which are predominantly three-dimensional. The museum itself is an exhibit, regarding the importance of its history and architecture. The exhibition entity consists of four levels with floors built around a patio and equipped with lateral openings (Fig. 2 a, b, c). The whole building occupies an area of 595 sqm, and has been constructed by a rigid structure with masonry walls. The museum hosts its permanent exhibition, as well as temporary or itinerary ones.
The National Museum of Antiquities

The National Museum of Antiquities is the oldest museum in Algeria and Africa, inaugurated in 1896. After several displacements of the collections, the conversion of the first normal school of teachers into a museum permitted to fix these collections. The museum currently hosts historical and archeological pieces reflecting the history of Algeria and the Maghreb for two thousand years, with a collection of sculptures, ceramics, lamps, Roman pottery… which are mostly three-dimensional objects, through permanent and temporary exhibitions. The building, with a rigid structure of masonry walls, has several spaces distributed in the ground floor and arranged around a courtyard (Fig.3 a, b). It has side openings with a skylight in the dome (temporary exhibitions space) (fig.3 c).

Figure 3: (a) Ground floor  (b) Elevation  (c) Temporary exhibitions space.

Method

This study was conducted in two major phases: the first based on a literature review of exhibition types, requirements and conditions of expographic lighting quality. Through this literature review, we tried to synthesize the recommendations of the expographic lighting, combining natural and artificial lighting, in terms of “ambient” and “accent” lighting (for 2D and 3D objects). These recommendations have been formulated as a reference tool used in the following phase. The second phase concerned the assessment of expographic lighting quality in three reused museums with the recommendations’ filter. This assessment is essentially based on observation, graphic and photographic supports collected by the author.

RESULTS

The following table summarizes, from literature review, the recommendations related to the choice of lighting type, whether natural or artificial, depending on expographic requirements for “ambient” and “accent” lighting.

<table>
<thead>
<tr>
<th></th>
<th>Natural</th>
<th>Artificial</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Lateral</td>
<td>Zenithal</td>
</tr>
</tbody>
</table>

Rec. = Recommended / ¹For dramatic ambiences / ²For soft ambiences

Table 3. Assessment of natural and artificial expographic lighting in the case studies

Museum of arts and Traditions
Museum of Modern art
Museum of Antiquities
Case 1: The Museum Of Modern Art of Algiers

The “Museum of Modern Art” hosting temporary exhibitions has a number of advantages in term of “expographic” lighting such as overhead natural lighting devices, which theoretically represent the best source recommended for temporary exhibitions. But the devices composed of three large domes and little skylights do not ensure a sufficient “ambient” lighting because of the important height of the atriums, composed of 4 floors (fig.4a). To resort to this weakness, a supplied indirect artificial lighting has been installed with fluorescent projectors oriented to the ceiling (55W/4000K/IRC>90), direct projectors oriented to the floor (fig.4b) and indirect lighting embedded in the ceiling (indirect diffuse-batten fluorescent luminair- 54W/4000K/IRC>90) (fig.4d). The central atrium space is then provided with a soft light uniformly distributed. Without the “accent” lighting, the paintings form a single unit with their background. Artificial light plays its substitution but also its widening work role, and meets the needs of “accent” lighting, highlighting the exhibits and offers opportunities necessary for the flexibility of a space welcoming temporary exhibitions. Through rotating spotlights on rails, that ensure the emphasis of artwork with a direct focused or framed lighting (halogen lamps 50W-3200K-IRC100) (fig.4e), it highlights the artworks that stand out from their background, to guide the look toward the artwork, an effect exacerbated by a lower “ambient” illumination (fig.4c). These devices generate a combined lighting predominantly artificial for the temporary exhibitions.

Figure 4: Interior photographies of the museum (atrium and the gallery at the 1st floor).

According to the synthesis table (tab.3), the MAMA museum should meet the "Highly recommended" device for natural lighting, but in reality, with the narrow and deep spatial form of the atrium the natural light is insufficient for “ambient” requirements and completely absent for “accent” expographic requirements. So, deficient natural lighting has been supplied by focused artificial lighting, highly recommended for 2D and 3D objects, adapted to temporary exhibitions that the museum welcomes. Although the artificial lighting ensures adequate expographic lighting, its dominance induces important consequences on the energy consumption.

Case 2: The Museum of Popular Arts and Traditions

The “ambient” lighting is provided by a diffused natural light penetrating through the entrance and windows (fig.5). The lack of artificial lighting here may be a problem when the illumination drops. The “accent” lighting here is provided by adjustable halogen spotlights (20W-3000K-IRC>90), with direct light focused but illuminating a small area of the space and the exhibits in the showcase (fig.5). The exhibits are mostly three-dimensional and lack “accent” lighting, knowing that the diffuse daylight in this space offers little modeling, especially when the sky is cloudy.
The specificity of this museum lies in the fact that it is a "heritage", with heavy loadbearing walls of historical nature. In this case, the lighting of the building and its architecture is as important as objects that are exhibited. The exhibition spaces here are too small for the collections that are hosted and do not allow the visitor to move back and appreciate the exhibition. According to the table 3, the museum should meet the "highly recommended" devices for artificial lighting, but in reality, the presence of this light does not meet the quality requirements, given the number and orientation of lighting devices, that do not fit the needs in terms of expographic lighting. As for the natural lighting, the only existing device is side lighting, which does not necessarily ensure the level of illumination needed for the exhibition, which would have been suitable for permanent 3D collections of small or average size only. The adaptation of the exhibition to the space should be taken into account by the designers, through the ability of the building to accommodate (structure, accessibility, strength of the frame, etc) with a light that targets the architecture of the building, as well as the exhibits.

Case 3: The National Museum of antiquities

Natural diffused light entering through the windows positioned at an important height (gaining exhibition surface) and featuring a diffusing glazing, helps illuminate the space and the objects that are on display (fig.6a). This natural source is supplied by a direct artificial light, with fluorescent tubes (58W-5250 lm-IRC>80) (fig.6b, c), which remains insufficient in case of illumination drop, given the number of devices and surface space. In this museum, the emphasis of the collection is ensured by natural lateral light which in case of high levels; significant shading patterns are generated on sculptures. In the table 3, lateral natural lighting is highly recommend, but in this case study the high proportions of the sculptures, compared to the space measurements and the windows’ disposal, led to the need of artificial light supply for “accent” requirements. This supply should enhance the exhibition quality of the artworks, but artificial “accent” lighting is only present in the showcase (direct diffused lighting).

According to the synthesis table 3, the Museum meets the "highly recommended" devices for artificial lighting, but in reality this light does not answer all the quality requirements, in terms of number and type. With the lateral natural lighting, the spaces are only side-lit, which is certainly favorable for some sculptures, but in excess for high sculptures and insufficient for accentuation of small 3D objects and 2D objects. All the “accent” expographic lighting defaults should be corrected by supplying the space with artificial lighting adapted to each space and to each type of objects. In this museum, two main problems arise: the first is the abundance and numerous varieties of museal objects
face to the rigidity of the spaces (fig. 6a, c) and the second is the same combined lighting devices existing in all exhibition spaces despite the big variety of the collections. For these permanent collections, improving the combined lighting according to every collection requirements will considerably enhance the expographic quality; but in our opinion, if the museum was adapted to the first collections in 1896, today this important cultural heritage deserves to be hosted in a new building museum with more flexibility and more adapted expographic lighting, specially designed for these collections.

CONCLUSION

Some converted museums offer better expographic lighting than others. Through this preliminary study, it seems clear that the conversion of a building into a museum requires an assiduous appraisal to evaluate the opportunities that the building offers. Strengths and weaknesses should be studied in accordance to numerous factors among which are the exhibition type (permanent or temporal), the collections requirements (2D, 3D, proportions), the conservation requirements and the energy consumption. From the case studies assessment, we retain that more the converted building offer flexible spaces, more it can fit the expographic lighting requirements but with heavy consequence on energy consumption when the natural lighting is insufficient. The Museum of Modern Art of Algiers seems to fit the expographic lighting requirements for temporary collections with the flexible spaces it offers, particularly the central atrium capturing the zenithal natural ambient lighting, even if insufficient. In its category as a museum of temporary exhibition, it seems to be a good example needing extensive study of its artificial lighting in order to reduce the energy consumption. In its category as a museum of permanent exhibition, the museum of Popular Arts and Traditions seems also to be a good example of collections adaptation to the space. The natural lighting is insufficient and the supplying artificial lighting should enhance both the expographic and the historical character of the building. The third museum seems to be the worst example, where spaces don’t fit either objects proportions or lighting requirements. The main recommendations we retain from this preliminary study is that in a reused building, the “natural lighting” should be the first considered and foremost factor to chose appropriate collections and to supply with adapted artificial lighting with energy consumption care.

REFERENCES