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Light in airport interior design, considering its pollution effects on ecosystems

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ABSTRACT

"When we add light to the environment, that has the potential to disrupt habitat, just like running a bulldozer over the landscape can." Scientific evidence suggests that artificial light at night has adverse and deadly effects on many creatures, including amphibians, birds, mammals, insects and plants. Nocturnal animals sleep during the day and are active at night. Light pollution radically alters their nighttime environment by turning night into day. The article gives an idea of the current direction of design - lighting design, where light is considered as an integral part of the interior. Besides, it focuses on the detrimental effects of artificial light on ecosystems and attempts to minimize the damage. The popular trend, its impact on modern interior design, architecture, and the spatial environment is briefly decrypted. The types of lighting and the characteristic of their significance in the interior are described. A new stylistic, compositional colour and lighting solution, modern technologies and lighting materials are introduced and analyzed in this airport interior design. Lighting was created depending on the tasks with the help of general, local (target), accent lighting and light-emitting fibre. General and local lighting help to solve visual problems, and accident lighting is designed to decorate this interior, drawing attention to architectural details, changing the visual perception of space. In the project, accent lighting is used on the bar counter and in some parts of the room. The main non-traditional, or rather the latest way of lighting in our project is the light-emitting tubes used in an art object that imitates a tree in the airport waiting area. It is assumed that in this interior, it is also possible to create a lighting scenario where it is worth "dimming" the lighting above the tables to make the sometimes required, more relaxed atmosphere or adjust the lighting program for the tree sculpture so that it "shimmers" with lights. The location of such a statue in the cafe area will attract the attention of potential visitors.

Keywords: Lighting design, Interior, General lighting, Local lighting, Airport lighting, Accent lighting. Airport lighting, Ecosystems, Pollution effects.

INTRODUCTION

The role of light in the formation of space is difficult to overestimate. Properly built lighting can visually transform the volume of space without affecting the design and architecture. Properly selected and placed lighting equipment is able to give the environment a certain mood and style. But, improper lighting can destroy the whole idea of a designer. Being one of the most important components of the interior, lighting requires a certain meaningful approach, preliminary planning and certain knowledge. Light plays a key role in our perception of the world around us and can set the tone and mood for everything happening around (Kucherenko 2017; Karim *et al.* 2020).

A created configuration venture for lighting a 24-hour bistro at probably the biggest air terminal in Russia was illustrated (Pleshkov *et al.* 2020). It is demonstrated that the relationship between eco-plan and air terminal standing is under the huge impact of biospheric esteem. Also, air terminal standing and abstract prosperity intervened the impact of eco-plan on expectations (Han *et al.* 2020).

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the ideal plan alternatives of light-rack boundaries have extraordinary potential for illuminance improvement (Bahdad *et al.* 2020). Methodological reflections on the utilization of plan as a technique in Copenhagen Airport was readied (Hernandez Bueno 2020).

Lighting design is the art of controlling light, where the main task of the designer is to create an attractive and comfortable space, as well as interacting with the environment, affecting the emotions and mood of a person. This art is based on a scientific understanding of the physical aspects of light, on the principles of design and operation of light sources. In work, the light designer relies on aesthetic perception, energy efficiency and the ergonomic aspect (http://www.o-svet.ru). Overall, the chief purpose of the study was to discuss Light in Airport Interior Design, along with considering its Pollution Effects on Ecosystems.

MATERIALS AND METHODS

Today, lighting design is a popular direction of design development. Until the 19th century, only solar, moonlight and firelight (wood chips, splinters, oil lamps, etc.) were at the disposal of people. And currently, there is a large selection of lighting devices and light sources for solving various problems. Modern lighting design is able to create amazing illusions, change the perception of space, enhance and emphasize details. In the field of lighting design, several independent areas can be distinguished: architectural and artistic lighting of buildings (lighting design of facades), landscape lighting and interior lighting design. There are features of the proper planning of light in the interior. Lighting differs in several types.

Consider lighting, the purpose of which is to provide a sufficient amount of light in the room, as well as display the general concept of the design of the room. The influence of daylight on human physiology is undeniable. There are studies that consider the minimum requirements that take into account human needs for health and visibility in all types of activities, as well as the behaviour and comfort of people in buildings, taking into account year-round natural changes in physical quantities such as light, temperature, noise and energy consumption (Darula 2018).

The main (general) lighting can be realized with the help of chandeliers, hanging, overhead and built-in lighting devices. There is accent lighting. It creates an atmosphere and a finished look in the room. Accent light is used if necessary to show the viewer the "content" of the interior, to form an idea of the spatial arrangement of objects. With its help, they emphasize objects: vases, figurines and other objects worthy of emphasis. Local lighting can be considered as the third type of lighting. Such light is used to solve functional problems: creating comfortable conditions for reading, working or cooking. To do this, fixtures are built above the working area, sconces, table lamps or floor lamps are installed. The distribution of the light flux is also of several types: direct, diffused and reflected light.

A direct stream of light emanates from the emitter and is directed to the place to be illuminated. Examples of direct light fixtures include floodlights, spots, downlights, pendant or ceiling lights, at least 80% of the luminous flux of which is directed to the lower hemisphere, for example, in loft and minimalism interiors. They provide the necessary level of illumination on the surface, not illuminating the rest of the space.

The scattered light is soft, and even, it reduces the level of contrast and minimizes shadows. That light, which has no direction or source, fits the definition of scattered light, but in the real world there can be no such light. Such lighting is considered the softest and most pleasant for our eyes. With the help of just such a lamp emitting scattered light rays, you can create a particularly comfortable, cozy atmosphere, conducive to warm family leisure and friendly meetings. For this reason, such a light is ideal for those areas of the home interior that are designed to relax and rest. Its great advantage is the smoothing of visual defects in the interior because of muffles shadows in space. This property is often used by interior designers, bringing their projects to perfection. Therefore, diffuse is called dim, dim lighting. To create such a light in the room will help some types of chandeliers, ceiling and wall lamps.

They also distinguish between reflected light, which is obtained when a beam is refracted, directed at a wall, floor or ceiling. This kind of light is the most natural and soft. Manufacturers create fixtures that shine only with reflected light, but there are models that combine direct and reflected light. Depending on the task, you can choose the most suitable option. Light sources are divided into various types, such as natural and artificial (created by man). Sources of natural light are the sun's rays and the scattered light of the entire firmament. The spectral composition of the sun's rays has a beneficial effect on the emotional state of a person. Using this type of lighting while working on a room project is one of the tasks of a lighting designer. The main objective of

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artificial light sources in the design of the room is to create a comfortable level of lighting with a shortage of sunlight. Modern conceptions of artificial light are most often lamps. Nowadays, directional light fixtures are considered to be the most popular. Basically, they are designed for ceiling mounting and are the most convenient, suitable and aesthetic for rooms. However, directional light can be placed not only at the top, but also on the ceiling on steps, in cabinets, etc. Also, it is used to highlight decor elements. At one time, different authors investigated the joint work of two independently scattered components of diffused (reflected from the ceiling) and directional (direct) light with an adjustable flow (Belyakova, 2019).

Using specific light sources can create a semblance of natural light. There is also a combined option when artificial light sources supplement natural lighting. This will increase the light in the desired areas of the room and create a comfortable atmosphere.

RESULTS AND DISCUSSION

Having studied the features of light in design, we offer our own conceptual solution for lighting design in the interior of the airport. When solving the problem of the distribution of light flux, an important aspect is the zoning of the room. In our case, we have a relaxation area (2nd floor), a waiting area and a cafe.

We divided the airport interior lighting into 4 types depending on visual and decorative tasks: general lighting, local (target) lighting, accent lighting, light-emitting fibre. Provide a sufficient amount of light in the room, display the general concept of the interior design of the airport will help the general lighting of the waiting area and recreation area. The main lighting is realized with the help of built-in lighting devices. In general lighting, uniformity of lighting is ensured: the illumination of the darkest part is at least 70% of the lighting of the brightest part. The use of ceiling pendant lights is proposed. Ring luminescent lamps are installed in the luminaires, which give enough light for general lighting.

Fluorescent lamps have one of the significant advantages - they consume less electricity, and that is why they have gained such wide popularity, unlike the lamps of the previous generation. Lamps were primarily integrated into the interior of every home, thanks to high-quality and economical lighting. In the process of improvement and testing, the fluorescent lamp gained additional benefits - harmlessness, safety and noiselessness.

Today, they come in a variety of sizes, including light bulbs used as light sources. The light emitted by fluorescent lamps creates a comfortable atmosphere for the activity. They are in demand in the office, in general education, in health facilities, as well as in the house, it is enough to choose the colour. Fluorescent lamps are capable of emitting light of different shades. In each of the listed illumination, you can find almost the entire spectrum - from bright white to blue and green. Thanks to the use of flasks with a diverse coating, they emit light of different shades and colours, creating exceptional decorative solutions, so the lamps are widely used in the design of rooms. In our opinion, it is advisable to use them, because at the airport there is no need to often turn them off, but it is known that their period directly depends on the frequency of on-off.

Local target lighting is intended for visual tasks that are performed on the territory of the cafe. The luminaires are installed in such a way that they provide the required lighting in those places where certain tasks are performed. On the territory of the cafe, warm light is used above the tables, which is necessary for a pleasant and relaxing pastime.

When lighting dining tables, it is vital to ensure both good illuminations of the surface of the table and to illuminate the faces of people sitting at the table, so we suggest using LED lamps. The LED lamp is one of the most environmentally friendly light sources. The principle of LED illumination allows the use of safe components in the production and operation of the lamp itself. LED lamps do not use substances containing mercury, so they are not dangerous in case of failure or destruction.

LED lighting may consist of finished devices - fixtures and elements for institutions - replaceable lamps. The advantage of LED lamps compared to incandescent lamps is low energy consumption, declared long life from 30,000 to 50,000 or more hours, ease of installation, lower body temperature compared to an incandescent lamp having a comparable brightness, high mechanical strength, and often - small dimensions. Complete environmental safety allows you to save the environment without requiring special conditions for disposal: does not contain mercury, its derivatives and other toxic, harmful or dangerous constituent materials and substances. Reducing energy through low-cost energy supply systems is considered by various scientists as a problem (Digert 2001; Arekhi & Jamshidi 2018). In projects, designers try to get by with the necessary minimum of fixtures, which, nevertheless, should provide 2, and preferably three types of lighting. In our case, correctly

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selected and correctly installed lamps provide 4 types of lighting. General and local lighting help to solve visual problems, and accent lighting is designed to decorate this interior, draw attention to architectural details, and change the visual perception of space. In the proposed project, accent lighting is used on the bottom of the bar counter and in some parts of the room.

In the interiors of the airport, the pastel colour scheme is most often used, because it is characterized by restraint. This is explained by the fact that a large number of people are frequently present in the hall, and the task of such an interior is to create comfortable conditions for visitors to wait for flights and for visitors to design a design that corresponds to everyone's workplace. And it is a colour scheme that makes it possible to emphasize the right space of the room (https://italstroy.ru). It is understood that the waiting area will be decorated in neutral beige, and the cafe area will have a more warm beige colour. Some studies discuss emerging issues in room design, including the impact of technological advances on employee satisfaction and productivity (Wineman 1982).

It is believed that yellowish lamps create a cozy atmosphere that promotes rest and relaxation, they are recommended for living rooms, but, based on a survey of respondents, not everybody prefers them. Devices of blue shades help to tune to the working mood and are used in offices. Light with a high light temperature should be used in interiors with a "cold" shade, and light with a low light temperature, on the contrary, in interiors with a "warm" shade (Runge & Manusevich, 2005). We offer neutral white lamps, as they create lighting in terms of brightness and saturation between a calm yellowish light and a bluish daylight lamp, for the best comfort of most. There are studies on the effect of light on humans. For example, cold white lighting is considered more stressful for humans than full-spectrum lighting due to the physiological impacts related to their spectral differences (Basso 1996). In our project, there is a "mixing" of "warm" and "cold" shades of light.

We suggest using light from fluorescent lamps as an accent in an art object stylized as a decorative tree and in other areas of interior elements. Through the use of large and small lamp sizes, an illusion of movement is created. In order for accent lighting to be able to highlight a particular element, the illumination of accent lighting should exceed the lighting from other lamps by 2-4 times. In addition, they have protective properties: dust and water resistance, which is necessary for any interior. Due to this, they can be used in swimming pools, laboratories, production shops and warehouses, in the air of which contains a large amount of moisture and dust.

The main non-traditional, or rather the latest way of lighting in our project is light-emitting tubes used in an art object that imitates a tree in the interior of the airport.

Material woven from pipes was used by Loop.pH to create tree sculptures for the city. This is a fibre that is manually weaved from light-emitting tubes that absorb light in the daytime and produce it at night, replacing both of lightboxes and garlands. The studio created sculptures, which are luminous trees, so necessary for cities to diversify areas with concrete "boxes". The project was called "SonUmbra Trees art project" and focused on clean energy. Innovative material can be used both to create different light sculptures, decorative elements of the interior and building facades, as well as an addition to existing art objects. The inventors assumed to weave the light-emitting fibre into a single "fabric" from which it would be possible to weave light and almost invisible figures in the afternoon for parks and streets. But, in the evening and at night, they had to produce a fantastic effect, highlighting with unusual shapes, interlacing and patterns in the dark (http://www.mem-it.ru).

In our project, the wood sculpture is supposed to be created from processed wooden boards, or from composite material. The sculptural protruding ribs of the sculpture are framed by flexible tubes that absorb light during the day and unusually glow at night. These light fibres are located on the borders of each part of the tree. An unforgettable sight is created, especially on the eve of the Christmas and New Year holidays, when everything around is lit with lights and adds festive emotions. On regular and weekend days, it will also be nice for passengers to visit, dipping them in a pleasant atmosphere before the flight, setting them up for positive thoughts in front of the road. Which, perhaps, is not out of place for a particular category of people experiencing neurosis before flying.

This art object is the dominant component of the hall, eye-catching. This composite element is given the greatest importance. Such formal amplification is the visual centre. The dominant expresses a compositional and semantic centre and connects the location of the recreation area, waiting for area and cafe. Visitors should have the impression that they are resting under a tree. Despite the fact that the centre has many elements of composition, it looks like a whole. The presence of equilibrium, expressed with the help of form and light, expresses the balance of masses in the composition. Therefore it contributes to the perception of the design object as a harmonious whole.

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SUMMARY

Thus, light plays a significant role in interior design in the formation of space. Properly built lighting is able to transform the space without affecting the design and architecture visually. Recently, it has become fashionable and convenient to create light scenarios. This was made possible thanks to modern technologies that allow you to control lighting, customize various scenarios for specific tasks or required conditions. We suggest that in this interior, you can also create a scenario plan where you can "dim" the lighting near the tables, to create the sometimes required, more relaxed atmosphere or allow the tree to "sparkle" with lights, after some time interval, for a festive accent. In addition, the sculpture, located next to the cafe area, allows you to attract potential visitors.

CONCLUSIONS

Nowadays, lighting also acts as a decorative element in the interior. In our airport interior design, we have applied the latest light technologies. Different types of light create specific zoning. With the help of light in this interior, it becomes possible to focus on the details, change the space. The competent distribution of light sources favourably affects not only the functional, aesthetic component but also the emotional state of a person.

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اثر نور در طراحی داخلی فرودگاه‌ها با در نظر گرفتن اثرات آلودگی آن بر اکوسیستم

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چکیده

وقتی که نور را به محیط اضافه می‌کنیم، همانند بولدوزری که باعث تخریب فضای سبز و منظره می‌شود، توان بالقوه تخریب زیستگاه را دارد. شواهد علمی نشان می‌دهد که نور مصنوعی در شب، اثرات مرگبار و مخربی روی بسیاری از موجودات ازجمله دوزیستان، پرندگان، پستانداران، حشرات و گیاهان دارد. حیوانات شبگرد، در طی روز می‌خوابند و در طی شب فعال هستند. آلودگی نوری به شدت موجب تغییر محیط شبانه‌ی آن‌ها از طریق تبدیل شب به روز می‌شود. در این مطالعه، نظریه‌ای در خصوص فرایند فعلی طراحی- طراحی روشنایی- ارائه می‌شود که در آن نور بخش مهمی از طراحی فضای داخلی است. به‌علاوه، در این مطالعه بر اثرات مضر نور مصنوعی روی اکوسیستم و روش‌های کاهش خطرات آن تأکید شده است. روند متداول، اثرات آن بر روی طراحی فضای داخلی مدرن، معماری و محیط مکانی، به طور خلاصه توصیف می‌شود. انواع روشنایی (نور) و ویژگی‌های آن‌ها در طراحی داخلی بررسی می‌شود. یک راه حل جدید، با روشنایی و رنگ ترکیبی، فناوری‌های مدرن و نیز مواد روشنایی معرفی شده و در طراحی فضای داخلی فرودگاه تحلیل خواهد شد. روشنایی بر اساس فیبرهای ساطع کننده‌ی نور، نورپردازی تاکیدی[1] و محلی ایجاد شد. نورپردازی و روشنایی عمومی و محلی به حل مشکلات بصری کمک می‌کند و نورپردازی تأکیدی برای تزیین فضای داخلی با در نظر گرفتن ویژگی‌های معماری و تغییر ادراک بصری از فضا یا مکان طراحی می‌شود. در این پروژه، نورپردازی تأکیدی بر روی پیشخوان‌ها و در بخش‌هایی از اتاق استفاده شد. جدیدترین شیوه‌ی نورپردازی یا روشنایی در این مطالعه، لوله‌های گسیلش نور در اشیای هنری است که به صورت یک درخت سالن انتشار فرودگاه شبیه سازی شده است. فرض شده است که در این فضای داخلی، امکان ایجاد سناریوی نورپردازی وجود دارد که موجب ایجاد فضای آرام و یا حتی تعدیل یا تنظیم برنامه‌ی نورپردازی برای مجسمه‌های درختی می‌شود. موقعیت این مجسمه‌ها در کافه تریا، توجه بازدید کنندگان را به خود جلب می‌کند.

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