



Optimization and Design of Bionic Lighting Lamps

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Abstract: with the development and improvement of modern science and technology, people's material consumption is gradually satisfied, the emotional consumption of sensory satisfaction begins to get people's attention, people's demand for products is not only excellent function, but also human touch. Lamps and lanterns regards every family as indispensable thing, the demand of people to lamps and lanterns from at first simple illumine function, transition to function and adornment pay equal attention to gradually, modelling of lamps and lanterns more and more incline to diversification, individuation. The design of bionic lamps and lanterns not only enriches the shapes of lamps and lanterns, but also brings a lot of fun and vitality to human life in a more pleasing, humorous and amiable way.

Keywords: Luminaire, bionics, guide, design.

1. Introduction

Outdoor light as the name suggests is exposed in the outdoor lighting fixtures. Lighting design and installation can usually be combined with surrounding roads, landscapes and buildings to achieve the unity of functionality and artistry. The outdoor lamps include street lamps, landscape lamps, lawn lamps, ground lamps, wall lamps, outdoor spotlights, projection lights, wall washing lights, etc.

And biomimetics refers to all things of the nature of "shape", "color", "sound", "function", "structure" and so on as the research object, and selectively in the process of design principles for the design of the application of these characteristics, at the same time, combining with the results of bionics, provide design new thoughts, new theory, new method and new way.

The research scope of bionic design includes the external forms and symbolic meanings of organisms (including animals, plants, microorganisms and humans) and natural substances (such as the sun, moon, wind, clouds, mountains, rivers, thunder, electricity, etc.), and how to apply them into design through corresponding processing

techniques.

2. Project analysis

2.1 Design direction

The design direction is the design of bionic outdoor lighting lamps based on road signs. In view of modern thinking mode, psychological situation, behavior habits, life characteristics and so on, in the original design of the basic function and performance of the foundation, based on the signpost guide system, the outdoor lighting design, make it more in line with the needs of modern people.

2.2 Specific content and method of design

First, consult and collect data, and conduct classified access to the data. Read, collect historical and current materials, make reasonable use of book resources, network resources, etc., and through screening, statistical analysis of the investigation to get all kinds of information to make reasonable use of network resources.

Through reading materials, the methods of on-the-spot investigation, in view of the outdoor lamps and lanterns of research and analyze space partition function and cultural connotation, to outdoor lamps and lanterns in the application of road signs advertising system, emphatically discusses the outdoor lamps and lanterns in the role of tourism environment space and the design principle, which embodies the value of outdoor lamps and lanterns, helps to better for the design of outdoor lamps and lanterns and integration.

Then I will consult with my classmates or teachers about the analysis results, ask some design companies, talk with professional designers, and sort out the useful information.

3. Research and analysis

3.1 Historical development and classification of lamps and lanterns

The low pressure sodium lamp, the vapor lamp appears, is by seals in the glass tube each kind of element vapor to pass by the electric current to emit light. Vapor lamp has mercury vapor lamp, sodium vapor lamp. Light efficiency is the highest, but only radiation monochrome yellow light, this kind of lamp lighting situation is impossible to distinguish between different colors. Main applications: road lighting, safety lighting and similar outdoor applications. Its luminous efficiency is 2 times of fluorescent lamp, 10 times of halogen tungsten lamp. Compared with fluorescent lamp, discharge tube of low pressure sodium lamp is long tube shape, usually bend into "U" type, put discharge tube in the outer glass shell of interlayer which is pumped into vacuum, the outer glass shell of interlayer is coated with infrared reflector to achieve the purpose

of saving energy and improving the maximum light efficiency.

High intensity gas discharge lamp (HID), this kind of lamp is high pressure discharge lamp, is characterized by a short high brightness arc discharge tube, usually discharge tube outside a certain shape of glass or quartz shell, shell is transparent or frosted, or coated with phosphor powder to increase the red radiation. It is divided into high pressure mercury vapor lamp (HPMV), high pressure sodium lamp (HPS), metal halide lamp (m-h).

Induction lamp, the new non - polar gas discharge lamp. The energy required is coupled to the discharge through a high-frequency field, and the transformer's secondary coils can produce an effective discharge. In form, induction lamps are another form of CFLS, but the high-voltage part may be different. The lamp is not limited to long tubes (such as fluorescent tubes), but can also emit light instantaneously. Operating at frequencies in the range of several megahertz and requiring special electronic circuitry to drive and control the lamp's ignition point.

Field luminescence lighting, including a variety of types of luminous panels and LED, LED for the latest photoelectric lighting technology, a wide range of applications, the collection of more than photoelectric technology advantages.

Since the birth of the world's first semiconductor light-emitting diode in the 1960s, LED lighting has been hailed as the light of hope in the history of human lighting for its long life, energy-saving, colorful, safe and environmental features.

3.2 Analysis of sitting posture

Advantages:

A. It can exempt the ankle, knee, hip, spine and other joint parts of the human body from static muscle force, reduce energy consumption and eliminate fatigue

Sitting is better for circulation than standing

C. It is conducive to maintaining body stability, which is more suitable for delicate work

D. When operating with feet, keep the body in a stable posture, which is conducive to the operation.

Disadvantages:

A. It limits the range of human activities, especially the occasions that require the exertion of upper limbs, and it often requires the standing operation, and frequent sitting and sitting alternates will also lead to exhaustion.

B. long-term sitting posture will also affect human health, leading to abdominal muscle relaxation, abnormal curvature of the spine, and damage to some internal organs, such as digestive organs and respiratory organs

C. sitting for too long can also cause leg swelling and increased venous pressure. Thigh local pressure, increased blood flow resistance, causing discomfort.

Sitting posture orthopedic students:

In normal posture, the lumbar portion of the spine is convex, while the sacrum is recessed. In a good sitting position, the pressure is properly distributed on the intervertebral discs, and the muscle tissue bears a uniform static load.

When in an unnatural position, the pressure distribution in the intervertebral disc is not normal, which forms a pressure gradient. If the pressure is severe, the intervertebral disc will be squeezed out from between the lumbar vertebrae, pressing the central nervous system and causing discomfort such as waist pain and fatigue. Torso completely straight posture make severe spine bending, because of the intervertebral disc pressure cannot be normal distribution, the upper body of the load on the lumbar spine, cause discomfort, so the 90 degree Angle of the design of the chair is bad, the trunk forward position can make originally the former convex concave after lumbar spine straight and even reverse, this position is also very uncomfortable, consequently affects the normal bending of thoracic and cervical vertebrae, neck, back fatigue

Reason good sitting position: the waist and ham become 135 degrees, lumbar vertebra ministry has prop up.

Muscle activity:

The vertebrae are positioned by the muscles and tendons that surround them. Once the spine is out of its natural state, tendon tissue is subjected to mutual pressure (pulling or pressing), which increases muscle activity and leads to fatigue and soreness. Three groups of 2-3 lumbar dorsal spine rectus muscle electromyography with different sitting posture:



In straight sitting posture, the muscle activity of the lumbar spine is high, because the lumbar spine is stretched forward to make the muscle tissue tense. As shown in the figure below.



After providing backrest support for the lumbar spine, the activity decreased significantly. As shown in the figure below.



The muscles of the upper back and shoulders are more active when the torso is leaning forward.

3.3 Color analysis Visual Pathway

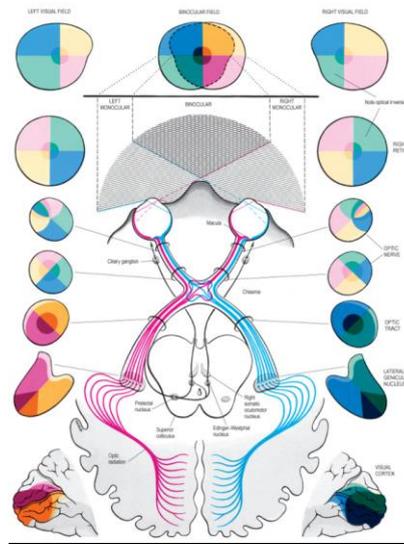


FIG1 cross-sectional view of human visual pathways

All human eyes have nasal side and temporal side vision, after the Retina (Retina) to detect light signal, the left and right sides of the Optic nerve transfer signal backward, the Optic Chiasma (Optic Chiasma) will each Lateral rhotomy and temporal signal shunt and continue to pass back, shunt left nerve on the right side of the visual signals only after nasal side (left eye and right temporal horizons), on the left side of the visual signals on the right side of neuroticism (Lateral nasal right temporal side view and left view), respectively by both sides of the Lateral Geniculate body (LGN, Lateral Geniculate Nucleus), This is then passed on to the Primary Visual Cortex of the occipital lobe (V1, Primary Visual Cortex) and to the more advanced Visual Cortex. Through this pathway, the object perceived by the retina will map to the visual cortex in a certain spatial relation [2], which is called a Retinotopy, as shown in FIG. 1.

It can be seen that the visual signal transduction pathway of the human brain is highly structured and has a clear division of labor before entering the cerebral cortex. After entering the primary visual cortex, visual signal processing will show the state of very complex, at present we are after the primary visual cortex's understanding of the visual signal processing is not completely clear, but this does not hinder us to understanding of the cognitive model of human brain cortex visual signal, which is the next part of the content: the structural characteristics of the visual information processing.

Structural features of visual information processing

After the visual signal is transferred to the primary visual cortex V1, it will continue to be transferred to the higher visual cortex. First, according to the anatomical results of Macaque Monkey's visual cortex, people reconstructed the hierarchical structure between its various visual cortices, as shown in figure 2.

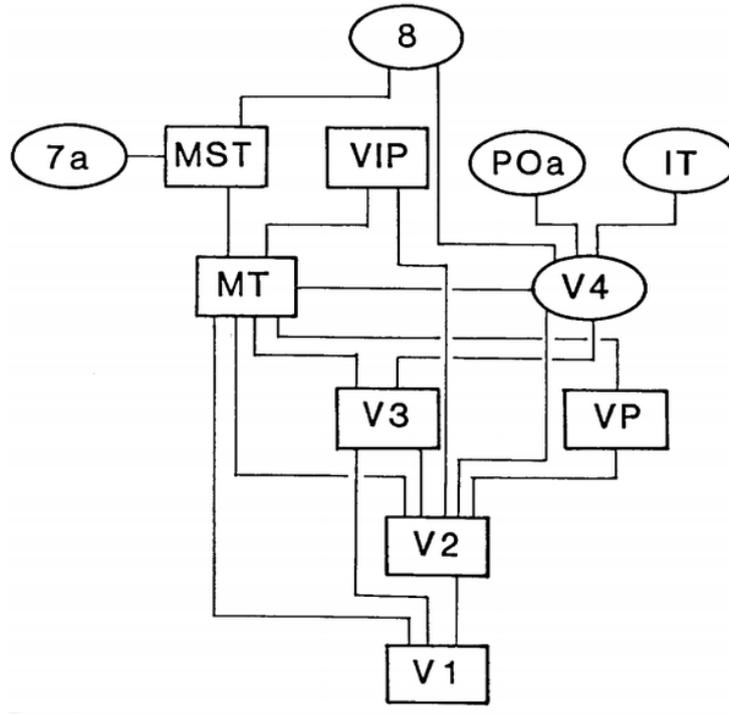


FIG 2 cortical regions of the human brain

The abbreviations in the figure above represent cortical regions associated with the human brain. On this basis, we came to understand the human eye
 Cortical hierarchical structure from the primary to more advanced visual cortex, visual information transfer level by level. The content understood by human brain becomes more and more complicated and abstract, from "mode" to concrete "thing", and then to the characteristics of things and the relationship between things, as shown in figure 3.

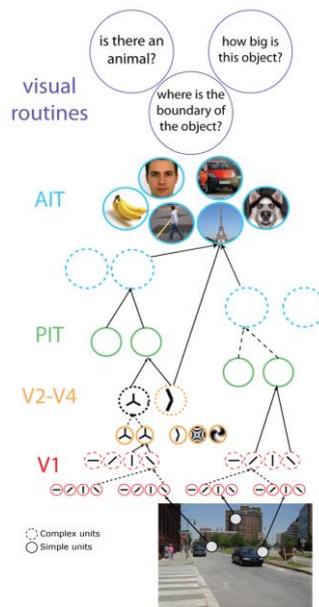


FIG 3 visual perception system

It can be seen that the image that is easy to compress has the following characteristics

compared with the image that is not easy to compress:

- A. regular layout (fewer things, regular location)
- B. simple colors (less theme colors)
- C. predictability (predictability of movement of things, predictability of change, etc.)
- D. common graphics/objects (easy to find matching models)
- E. Images that are easy to be compressed have low information processing pressure on the human brain, while images that are not easy to be compressed, on the contrary, will create processing pressure and make people feel depressive and potential panic. At the same time, you may have noticed that these laws can also be applied to other aspects, such as: photography, theme prominent; Background blurring (reducing unnecessary detail and unpredictability); Pay attention to layout; Color simple and so on.
- F. Clothing: do not wear more than three colors, try to wear solid colors; Do not have patterns on the clothes or patterns as simple as possible; Don't go overboard with the style.

The perception of black, white and gray does not need the introduction of color signals, and visual compression is easy. The color matching between black, white and gray is a very common color matching mode in nature (such as at night when there is no color perception), and it is easy to find a matching mode. So the human brain has less to do with black, white and grey. In addition, we often see the black, white and gray color pattern in solemn occasions. When we see this pattern in daily life, we also mix it with a serious feeling (the introduction of memory factors). Therefore, the design of outdoor lamps and lanterns also refers to colors that are easy to be compressed as much as possible.

3.4 Analysis of tourism demand

The China tourism academy and ctrip jointly released the research report on the trend of leisure tourism customer demand in China. This study objectively reflects the trend of leisure tourism consumption in China, the needs and behaviors of tourists and the changes of destination concern, which is of great reference value to the current burgeoning leisure tourism market. It is the first authoritative report on leisure tourism in China.

The China tourism research institute issued more than 30,000 on-site questionnaires in representative scenic spots. Meanwhile, this report was made according to the authoritative statistics of scientific model by referring to the database of ctrip. The survey covered the time of hot spots and 50 key tourist cities in seven regions. This study analyzes the characteristics and trends of Chinese residents' leisure tourism, covering domestic tourism, inbound tourism and outbound tourism market leisure

tourists, including leisure tourists' characteristics analysis, demand analysis and behavior analysis.

At present, the characteristics and trends of leisure tourism are mainly reflected in four aspects:

Economic characteristic is remarkable. From the perspective of income and expenditure level of the surveyed tourists, leisure tourists' tourism consumption level is relatively low. When making travel decisions, choosing travel agencies, means of transportation and accommodation facilities, leisure tourists should focus on cost.

The upgrade trend is obvious. According to the travel purpose of tourists, the degree of attention to scenic area (point) information and the influence of scenic attraction on travel decision-making, it can be judged that in a long period of time, sightseeing will be the main demand of leisure tourists, but new demands such as leisure vacation and self-driving travel are also increasing.

Pay more attention to urban comprehensive supporting services. Not only focus on tourists' attractions attractions such as the core tourism products, but also on accommodation information, folk customs tourism destinations, special shopping streets, traffic information, entertainment, tourism price information, in the process of practical experience and focus on tourist attraction, tourist traffic, accommodation cost, characteristic catering, leisure environment, tourism and other comprehensive factors. The function of network tourism service is increasingly prominent. The Internet has become an important way for tourists to obtain information, make product reservations and complain about travel services. More than 40% of domestic tourists have used the website /BBS/ BBS to obtain travel information. The proportion of inbound and outbound tourists using the Internet is higher, reaching 60% and 50% respectively.

According to the economical characteristics of leisure travelers and leisure tourism comprehensive, modern upgrading trend of tourism industry in the configuration element when should pay attention to economical facilities and service configuration, the construction of comprehensive information service system, the driving system and so on facilitation of infrastructure and public service system, make full use of network media tourist service function, increase the urban surrounding environment, tourism image, the comprehensive service marketing campaign as a whole.

According to the positioning crowd and applicable environment of this outdoor lighting, PC/ABS(polycarbonate and acrylonitrile-butadiene-styrene copolymer and mixture), aluminum and its aluminum alloy should be used as the main system

As materials, and the use of metal stamping processing and manufacturing.

4. Design development and scheme determination

4.1 Draft drawing

Through the research on "gesture", the abstract artistic expression form is extracted. Combined with the design principle of "form follows function", the design derivation of product appearance is carried out, as shown in figure 4.



FIG.4. Derivation sketch of lamp design

Through the extraction of the cobra's local morphological features and strengthening and abstract deformation, the design experiment was carried out. Combined with the design principle of "form follows function", the design of product shape was deduced. Through the streamlined design language and parametric design concept, the design experiment of lamp shape was carried out.

In scheme 4, the main features of the local shape of fingers were extracted, enhanced and abstracted out. Finally, after the key-shot rendering of the small picture for color deliberation, it was found that this design scheme was exactly what I wanted, as shown in figure 5.

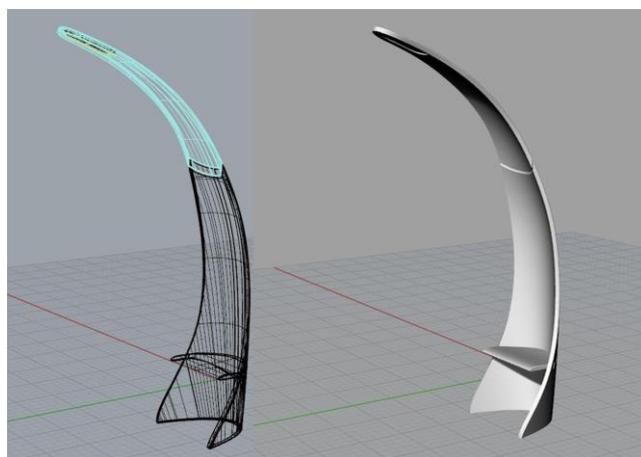


FIG. 5 3D effect of scheme 4

4.2 Interaction design

On the inside surface of outdoor lamps, the positions of nearby scenic spots are marked. Scanning the qr code can not only obtain the local visual map information, but also realize the intelligent control of the lamps within an effective distance through APP. There are road sign AR guidance, severe weather marking, light tone, mobile phone network antenna, SOS.

4.3 Final design process, effect drawing and three views

In order to protect tourists from the influence caused by bad weather, "embracing" design is adopted in the design of lamps and lanterns combined with man-machine engineering. Air circulation forms turbulence through its streamlined arc surface to avoid tourists. The curved curve of the lamp itself extends forward continuously, which also effectively blocks the harm of rain and snow to tourists. Only to get a security guarantee while enjoying an easy rest.

5. Conclusion

Through the completion of the subject of "outdoor lighting -- bionic design", I have a more comprehensive understanding of outdoor lighting. In the process of its evolution, outdoor lighting is constantly changing with the needs of human beings. When people's material consumption is gradually satisfied, people begin to pay attention to the emotional consumption of sensory satisfaction. People's requirements for products are not only excellent functions, but also human interest. While industrial technology products flood the living space, natural elements are needed to balance people's feelings, so as to obtain healthy psychological consumption. In the context of the rapid development of the Internet era, online tourism has rapidly occupied the market, with a blustery and dominant position. With the rapid increase of OTA tourism market share, most scenic spots have begun to vigorously build an "Internet +" smart tourism system. Under the background of modern information globalization, outdoor lamps and lanterns can not only lose their value and significance, but also better meet modern people's lifestyle and aesthetic needs through design. Recently, oct shenzhen cooperated with alitravel to open the "credit tour" mode, which was realized on the basis of Robins' smart tourism platform. Therefore, only through the development mode of Internet + scenic spot can the scenic spot have a continuous dialogue with tourists' needs, which is the original intention of designing this type of outdoor lighting.

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