

Discussion on the Future of Community Lighting for the Elderly and the Emotional Design of the Elderly

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Abstract: With the advent of a new era, the aging of the population will have an increasingly far-reaching impact on the working life of different ages. In the future, the aging community should not only create a green, safe, comfortable and humanized environment through lighting design, but also pay more attention to the acceptability of light for the elderly. Through the thinking of the future age-appropriate community, starting from the entertainment, rest, and shower space, this paper uses design to create a livable overall style, space atmosphere, and functionality for the elderly from the perspective of different areas and different lighting methods, and the living space for the elderly in the new era is reflected and improved by lighting design.

Keywords: Community Design; Lighting Design; Age-Appropriate; Emotional.

1. Contemporary Context

1.1. The Current Situation of Population Aging and the Trend of Pension in China

According to data from February 2023, the number of elderly people aged 60 and above in China reached 280 million, accounting for 19.8% of the total population, and the elderly population aged 65 and above reached 210 million, accounting for 14.8% of the total population, which means that China has entered a stage of deep aging. In order to cope with the phenomenon of population aging, the state adopted policies to set the tone, and proposed to "implement the national strategy of actively responding to population aging" at the Fifth Plenary Session of the 19th Central Committee. Since then, the state has successively issued a series of policies to encourage the development of the silver economy, and the "Outline of the 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Long-Range Objectives Through the Year 2035" proposes to promote the coordinated development of the pension industry and the pension industry. The upstream of the industrial chain mainly includes medical equipment, food and drugs and other basic materials that support the pension industry. The equipment is composed of intelligent hardware, rehabilitation aids, medical devices and monitoring equipment. Among them, intelligent hardware solves the problem of professional care with emerging technologies, which can alleviate the pain points of difficult monitoring of home care and high cost of community care and institutional care, which is one of the key development directions in the future. With the development of a new generation of information technology such as 5G technology, the Internet of Things, big data and cloud computing, it has injected new vitality into the smart pension model, and at the same time provided technical support for the operation of the smart pension model, which is conducive to solving the problem of domestic pension difficulties. With the advent of the new era, the problem of population aging is becoming more and more obvious, and the deepening population aging is an important social problem facing China at present. At present, many community construction in China emphasizes the physical environment over the social environment, the administrative

color is strong, the residents lack a sense of participation, and at the same time, there are passages and green spaces are also seriously occupied, and the community lights are dim, and it is difficult to meet the community pension needs of the elderly population. The construction of the future age-appropriate community is to take the needs of middle-aged and elderly people as the core, and is committed to meeting their beautiful yearning for a better life in the future, so the community is not only a simple meeting place, but also a space for people's leisure and entertainment.

In the future, it is essential to create an age-appropriate community lighting with a warm atmosphere. There are many problems with the lighting in the current community: dim lighting, large spacing between street lights, no signs at the steps, no night display on signs, etc. Through the design, it is hoped to improve the current situation of the community, and create a community suitable for the elderly to live and make the elderly young through lighting; By adjusting the brightness of the light, find the most suitable light source for the elderly, and no longer let the night become the reason for restricting the nightlife of the elderly; Through lighting, different functional zones are expressed, different elderly care atmospheres are felt, and a young community for the elderly is built.

1.2. Prospects and Research Trends of Intelligent Communities

In the new era, communities for the elderly need to meet the characteristics of intelligence and serve the elderly. First of all, we should focus on technology integration and innovation, and in the future, intelligent communities will pay more attention to the integration of different technologies to provide more comprehensive and efficient elderly care services. The deepening of innovative technology will continue to promote the improvement of the level of elderly care services and the improvement of the quality of life of the elderly. Through the smart health monitoring system, the health status of the elderly can be tracked in real time, problems can be detected early and preventive measures can be taken. Automated home facilities, such as smart lighting, smart security, and smart medical equipment, can make life more convenient and safe for the elderly, and enhance their independence and autonomy. Second, it is necessary to

respect the individual differences of the elderly and provide personalized services. Personalized elderly care services can help the elderly meet their needs for health management, dietary arrangements, recreational activities, etc. In addition, the intelligent home-based elderly care model can reduce the cost of elderly care services for community residents. Automation and intelligent technologies can reduce the burden on community service personnel, improve work efficiency, and reduce operating costs.

At the same time, through telemedicine and health monitoring services, medical staff can manage the health of multiple elderly people more effectively and reduce unnecessary waste of medical resources. Finally, the digital integration of social interactions and recreational activities can promote the mental health of older adults and make their lives in nursing homes happier. Leveraging features such as virtual communities, online entertainment, and remote contact with friends and family can help seniors stay socially active and reduce the psychological problems that come with loneliness. However, the development of intelligent nursing homes also faces some challenges. Therefore, individuals, society and the government need to work together to establish a sound legal system to promote the sustainable development of intelligent elderly care services.

2. Needs Analysis of Older Adults

When people reach old age, they are often in a state of gradual reduction from their original social ties to the point of isolation from society. Social isolation is defined as a state in which an individual lacks a sense of social belonging, contact and social interaction with others, and a lack of satisfying and high-quality social relationships. Therefore, the social needs of the elderly are becoming more and more important in an increasingly aging society. As they grow older, many elderly people may face the problem of fewer relatives and friends, decreased physical health and feel lonely, and the busyness of children will also become an important reason for the elderly to feel lonely, and social activities have become one of the important ways to maintain physical and mental health.

By participating in social activities, older people are able to form new friendships, share life experiences with each other, and enhance their sense of belonging in society. Mental health and physical health are equally important, and socializing is good for the mental health of older adults. Socializing with others can reduce loneliness and prevent depression and anxiety. At the same time, participating in group activities or social gatherings can help improve the psychological quality of the elderly and seek resonance in life, so as to gradually adapt to the new life and have a positive attitude towards life. Older people can also keep their brains active through activities such as reading, playing games and learning new skills, preventing cognitive decline.

With the development of society, the elderly also have a certain demand for housing and the surrounding environment. Safety is the most important design principle for age-appropriate homes, such as installation in an indoor environment

3. The Importance of Lighting in Age-appropriate Communities

The importance of lighting in age-friendly communities is manifold. Middle-aged and elderly people will have different degrees of deterioration in hearing, vision, smell, and taste

due to their own aging, so the design of future age-appropriate communities will take into account the visual impairment or light sensitivity problems that community residents usually face, so a well-designed lighting system is essential to prevent falls, quickly identify the environment, and provide an overall sense of security. This not only gives residents a sense of security in their lives, but also protects their physical health to the greatest extent.

The design of intelligent lighting can also make residents more convenient and quick to perceive the surrounding environment by enhancing the lighting intensity in different areas, and promote normal social activities to meet the specific psychological, physical and visual needs of middle-aged and elderly people. Lighting can directly improve their quality of life, for example, by providing residents who like to walk and jump in the square at night with bright and non-dazzling warm light, so as not to fall due to dim light during sports. Increasing age brings a sense of urgency and anxiety to older people, as they are often in a state of social isolation from their old social ties that are gradually diminishing. Social isolation is defined as a state in which an individual lacks a sense of social belonging, contact and social interaction with others, and a lack of satisfying and high-quality social relationships. Middle-aged and elderly people will often feel lonely and empty of doing nothing, they will become more and more powerless in the process of life, and even think about when they will tend to die...

The design of age-appropriate communities should focus on the emotional and psychological state of residents, and proper lighting can affect people's emotional and psychological state. The warm and soft light may help to elevate the mood of residents and reduce depression, which in turn improves overall mental health. And well-designed lighting can create a warm, comfortable environment that encourages interaction and socialization among community residents and reduces loneliness. In the design process, it is necessary not only to pay attention to the psychological state of the elderly, but also to create a good social environment to reduce the loneliness and frustration of the elderly. On the one hand, the elderly are addicted to smartphones and often look at their phones until the early hours of the morning; On the other hand, the living environment of the elderly, especially the lighting, causes them to not feel like falling asleep, and even feel energetic and can continue to watch TV. However, such an upside-down routine is extremely harmful to the human body, especially the middle-aged and elderly whose body functions are slowly declining. The design of smart lighting has become particularly tight, especially at night, where proper lighting design can help maintain residents' biological clocks and promote good sleep quality, which can have a positive impact on overall health.

4. Lighting and Emotional Design

4.1. Emotional Design Overview

Emotional design is a design approach that focuses on eliciting an emotional response from a user in a product, environment, or experience. Emotional design in lighting emphasizes the creation of light environments that generate positive emotional experiences. Emotional design puts the user experience at the heart of the design, emphasizing understanding and satisfying the user's perceptions, emotions, and needs. In the design of age-appropriate lighting, it is necessary to give priority to the special needs and feelings of

middle-aged and elderly people. Secondly, the purpose of the design is to enrich the experience of middle-aged and elderly residents by generating specific emotional responses, which can be comfort, peace of mind, warmth and other emotional experiences related to the lives of middle-aged and elderly people in terms of lighting. In the lighting design, the principle of perceptual psychology will be used for emotional design, focusing on the response of middle-aged and elderly residents to different colors, lighting, shapes and other perceptual factors, and using these factors to improve the experience of residents in life and leisure. Starting with details such as the choice of color, the intensity and direction of the light, and focusing on subtle design differences, as well as the overall layout of the light environment, we hope to create an effect with a specific emotion.

4.2. The Emotional Needs of Middle-aged and Older People for Lighting

The emotional needs of middle-aged and older adults should be given special attention in the design to ensure that the lighting system creates a positive emotional experience that is in line with their stage of life. First and foremost, the lighting needs to be designed to provide residents with a reliable sense of security. Bright and soft lighting needs to be provided in the corridor and house, especially in areas with more activities, which can enhance the sense of security of middle-aged and elderly people and reduce possible anxiety and tension. Middle-aged and elderly people often have trouble falling asleep, so they have to choose warm, soft light for lighting in the bedroom area. This creates a tranquil and welcoming environment for those who are ready to fall asleep, helping to improve the comfort of middle-aged and elderly people and reduce tension and fatigue. Secondly, changes in light can also affect changes in people's biological clocks. Consider the use of smart devices to simulate changes in natural light in lighting design, which can help maintain the biological clock of middle-aged and elderly people, and promote good sleep and daily rhythm.

Many of today's smart furniture can adjust the light individually, so adjustable lighting should also be provided in the age-appropriate home care community, so that the middle-aged and elderly can independently control the light according to their personal preferences and needs, and enhance their sense of independence and control. Finally, the mentality of the elderly is more sensitive, and indoor lighting should also make more use of soft lighting and specific lighting scenes to evoke the pleasant emotions of the middle-aged and elderly, stimulate good memories, and improve their overall well-being.

5. Age-appropriate Lighting Types and Their Impacts

The impact of different lighting types in age-appropriate communities is multifaceted, involving comfort, safety, and quality of life for middle-aged and older adults. Lighting is divided into two categories, natural lighting and artificial lighting. Both natural light and artificial lighting play an important role in age-friendly communities, and together they affect the quality of life and comfort of middle-aged and older adults.

Natural light is sunlight, is an indispensable factor for the growth of all things, natural light not only gives plants a good condition to thrive, but also sunlight can give people a good

mood. Therefore, in the design of age-appropriate communities, the interior design should have large windows, which can bring in enough natural light, which helps to maintain the residents' biological clock, promote normal sleep-wake patterns, and improve alertness during the day and deep sleep at night. Natural light is mostly warm colors, and warm natural light can enhance the mood of middle-aged and elderly people, reduce depression, and create a more pleasant and peaceful living environment. Evenly distributed and high-contrast natural light can improve visual clarity, reduce visual fatigue, increase occupant comfort, and maintain a connection to the natural environment in an indoor with sufficient natural light, improving overall mental health.

Artificial lighting can provide enough light at night or when natural light is insufficient to ensure that residents can complete various activities such as reading and cooking. It differs from natural light in that it is adjustable, allowing middle-aged and elderly people to adjust the level of light needed at this time according to different activities and personal preferences, increasing activity autonomy and personal adaptability. Artificial lighting can provide

adjustable brightness and color temperature, and middle-aged and elderly people can adjust the brightness and illuminance of the light according to different times and individual needs, increasing flexibility and personalization, among which soft warm light and white cool light are used the most. Soft and warm light tones are mostly warm light tones, such as yellow or orange, which can create a warm and tranquil atmosphere, which can help improve the comfort and emotional pleasure of middle-aged and elderly people; The cool white light can concentrate the user's attention and complete the task efficiently. So in scenes that require more attention and vibrancy, the use of cool white light can enhance visual contrast and improve visual clarity, which is suitable for tasks such as reading or crafting. Artificial lighting can be used for a certain task to provide targeted lighting for different activities, such as reading lights, kitchen lighting, etc., to ensure that middle-aged and elderly people have enough light when performing various tasks. Walkways are also the areas where artificial lighting is used the most, and the use of artificial lighting in corridors, stairs and other key areas not only ensures adequate illumination, but also improves residents' sense of safety and reduces the risk of falls.

Finally, the intelligent lighting system is the most widely used lighting method in the contemporary development process. Artificial lighting combined with intelligent control technology can automatically adjust the different lighting needs of people, automatically change according to environmental needs and residents' activities, and improve energy efficiency. It can automatically recognize the current time, light intensity and brightness for additional intelligent lighting, which is a good way to save electricity costs and effectively save energy and protect the environment. For example, in the nighttime environment, smart lighting facilities provide residents with soft nighttime lighting, helping middle-aged and elderly people to reduce visual impact when waking up at night, and promote easier sleep and re-sleep. Combined with sensors and intelligent control systems, lighting is automatically adjusted according to the activities and needs of middle-aged and elderly people, improving energy efficiency while ensuring proper illumination.

6. The Impact of Lighting on the Elderly

6.1. Effect of Color Temperature on Older Adults

Color temperature and brightness are two key parameters in lighting design, and their reasonable adjustment can significantly affect the comfort, security and visual clarity of middle-aged and elderly people. The design takes into account the special needs of middle-aged and elderly people, and the color temperature and brightness can be adjusted according to different areas and activities to create a pleasant and safe light environment; Some subtle adjustments can also be made according to the specific situation of the community and the individual differences of residents, and creating a warm and comfortable home environment requires the use of lower color temperatures, such as warm white or yellow light. This use of lower color temperatures can provide a warmer and more atmospheric living environment for indoor places, and is often considered to be warmer and more comfortable, helping to create a warm atmosphere at home and improve the comfort of middle-aged and elderly people. And the lower color temperature is closer to natural light, which helps to maintain the normal rhythm of the biological clock, and has a positive impact on the physiological health and good sleep patterns of middle-aged and elderly people. Higher color temperatures, such as cool white, are generally used in office spaces. It not only allows workers to have a clear sense, but also improves people's attention, so that workers can have more concentration at work and improve work efficiency. Indoor use in age-appropriate communities can increase alertness and attention in older adults.

6.2. The Effect of Brightness on the Elderly

First of all, the right brightness can help create an environment suitable for social activities, improve interaction between middle-aged and elderly people, and reduce loneliness. The activity room for the elderly in the community is often used, and the elderly go to make some like-minded friends, which can improve their satisfaction and happiness in life. In addition, sufficient brightness is very important for the elderly to do some delicate activities and complete various plans, and it is necessary to ensure that the activities provide sufficient illumination to reduce eye fatigue and physical fatigue. Walkway crossings and staircase openings are places where the frequency of accidents among the elderly is high, and the key reason for these accident-prone areas is that the lighting is not bright enough. Older people often feel dizzy due to deterioration of their visual function, which can cause them to see the road under their feet, think that there are no steps or handrails to hold firmly, and fall. The muscle atrophy of the elderly also causes their legs to slowly become weak, unable to stabilize their bodies at the first time of falling, and can only slide down sluggishly. Therefore, it is necessary to provide sufficient illumination and sufficient brightness in these places to help improve the sense of safety of middle-aged and elderly people, and reduce the risk of falling and being injured by not paying attention to the road due to excessive worry. Finally, sufficient lighting brightness can mobilize the spirit of the elderly, so that they are willing to get up and do something they like to do, enrich the lives of residents, and make life more rhythmic and happier.

6.3. The Impact of Sleep Lighting on the Elderly

In age-friendly communities, lighting has a profound impact on sleep quality. Scientific and healthy lighting design can help middle-aged and elderly people maintain healthier sleep patterns, reduce difficulty falling asleep and waking up at night, and improve overall sleep quality. The plan of the day begins in the morning, when the elderly wake up and are exposed to natural light, by which time the body's biological clock has prompted people to get ready to get up. This helps to adjust the body clock of the elderly to reverse their schedules, promote normal circadian rhythms, and at the same time speed up the process of falling asleep through the psychological cue of lights at night. In the selection of soft furnishings and lamps, suitable curtains or lamps with covers can ensure that there is no strong glare in the bedroom, reduce the impact of external light on the sleeping environment, and reduce the adverse effects of dizziness, vomiting and chest tightness caused by glare in the elderly. At night, the room should be illuminated with a lower color temperature, such as warm white or yellow light, which helps to simulate natural light at sunset and can effectively reduce the interference of blue light with melatonin secretion, so as to better prepare for sleep. Gradually reduce the lighting before falling asleep, and use soft lighting to help middle-aged and elderly people transition to a more relaxed state and promote easier sleeping. These can be made with smart lighting systems that adjust the lighting to the time of day and the needs of the individual, creating a light environment conducive to a good night's sleep.

7. Smart Lighting and Personalized Lighting

7.1. Overview of Smart Lighting Technologies

Smart lighting technology is a cutting-edge technology field that aims to automate and intelligent lighting systems by integrating advanced sensors, control systems, and communication technologies. Smart lighting technology plays an important role in age-appropriate communities to meet the individual needs of middle-aged and elderly people, improve energy efficiency, and create a more comfortable and safe living environment.

Smart lighting systems monitor changes in the environment in real time by integrating various sensors, such as motion sensors, light sensors, and temperature sensors. This allows the system to sense factors such as human activity, ambient brightness, and temperature, providing data support for adaptive lighting. Using the data collected by the sensors, the smart lighting system is able to automatically adjust the lighting level. For example, the system can automatically adjust the brightness and color temperature of the light based on the difference in time of day and night, simulating changes in natural light. Residents can be remotely programmed via smart devices such as smartphones or tablets. This means that middle-aged and elderly people can personalize the lighting system according to their individual preferences and activity needs. The smart lighting system can be remotely controlled, so that residents can remotely control the lighting equipment through the Internet anytime and anywhere, which provides greater convenience and flexibility for the lives of middle-aged and elderly people.

7.2. Overview of Personalized Lighting

Personalized lighting is a key concept in smart lighting technology, which aims to provide a lighting experience that is tailored to an individual's needs, preferences and activities. In age-appropriate communities, personalized lighting can better meet the special needs of middle-aged and elderly people and improve the quality of life.

The personalized lighting system allows the user to adjust the color temperature of the light, from warm yellow to cooler white, to suit different activities and times. For example, warm light tones can be used for relaxing and preparing for sleep at night, while cool-toned light is suitable for tasks that require more concentration. The personalized design also allows users to adjust the brightness level of the light according to their preferences and needs, and adjusting the brightness at the right time for different activities and environments can help improve visual comfort and reduce eye fatigue and dryness.

Personalized lighting can also be preset with different scene modes, such as reading mode, party mode, relaxation mode, etc., and the corresponding scene mode can be selected according to the current activity state, quickly adjust the lighting effect, and find the most comfortable lighting state. Personalized lighting can be connected to an intelligent voice system, and through the interconnection with personal devices such as smartphones or smart assistants, users can remotely control the lighting system via voice commands or an app, enabling more convenient and personalized adjustments. Finally, taking into account the health needs of middle-aged and elderly people, the personalized lighting system can adjust the lighting according to the biological clock, sleep situation and health status of users of different ages to promote a healthier, more comfortable and more flexible life.

8. Future Developments and Challenges

In the future, the smart lighting system will integrate other smart home devices more deeply, such as intelligent temperature control, intelligent security systems, etc., to form a more comprehensive intelligent ecology and provide a more comprehensive and convenient home experience for the elderly. Taking into account the health needs of the elderly, the future of smart lighting should also pay more attention to the impact of lighting on human physiology and mental health, provide more intelligent biological clock adjustment and sleep optimization functions, can better perceive the health status of users, adjust lighting according to physiological data, and provide more personalized health care. Lighting technology should be modernized with a focus on energy efficiency and environmental protection, with more energy-efficient and environmentally friendly lighting technologies to promote sustainable community development.

With the intensive use of smart lighting systems, a large amount of user data is collected, and privacy and data security issues have become more prominent, and stronger security measures are needed to protect user privacy. For the elderly, we want to provide intuitive and concise operation methods. Some older adults may be less receptive to new technologies and need more intuitive, easy-to-use interfaces and training to

ensure they can take full advantage of the capabilities of smart lighting systems.

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