Explore on color design of facilities space for adaptation aging in China

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Abstract. This study is conducted in the context of the increasingly serious aging problem in China and the increasing demand for age-appropriate facilities. This paper first analyzes the impact of color on the physiology and psychology of the elderly, then analyzes the physiological and psychological needs of the elderly for color, and finally puts forward the color design method for the facade, indoor environment and outdoor environment of aging facilities. The purpose of this study is to provide the elderly with a comfortable living, entertainment and service environment through color design.

1. Background
Facilities of adaptation aging includes elder daily caring centre, nursing home, elder activity centre, elder university, which become prevalent among Chinese elder for recreation activities, cultural communication, new things learning, service enjoying and social circle establishing. The environment suitable for aging facilities can directly or indirectly cause changes in the physical and mental aspects of the elderly. For the elderly, vision is a relatively direct and agile way of perceiving age-appropriate facilities among the five senses. Under that background, color design have advantage of efficient, convenient, practical and beauty in space environment, which is conducive to treat psychological and physical diseases. Color design that create life environment and atmosphere that elder needs helps elder to establish the sense of home and happiness aging life, rises identification and applicability of adaptation aging facilities.

2. More dimensions effect of color on elder

2.1. Color arouse effect of psychological and physiological
Color can divides into cold color, warm color, light color and heavy color etc. Different color can effect elder psychological activities that can be defined as subjective consciousness of elder following the objective color in different extend. At the same time, color effect on elder will reflect in behavior by color stimulus them physiological, which can be found in Fig 1. For example, elder heart will go fast and their behavior become active due to receive suggest of being excited and positive, when they see the warm color or high degree of saturation color like red and yellow; elder heart will have peace mood when they see the cold color and low degree of saturation color that suggest elder do not be anxiety, those kind color is helpful to decline blood pressure.
2.2. Color symbols and psychological implications for the elderly

Color is not a simple expression of a color, it can carry a symbolic meaning or have some connection with the elder's past experience, thus arousing the ripples of the old man's memory. This kind of characteristic of color can be used to build specific mobile place and dimensional atmosphere. For example, red will make most of the elderly evoke the excitement of the red revolution and the euphoria of the New Year, just like Orbec nursing home reflected in Fig. 2, uses red to decorate the activity space and create an active entertainment atmosphere; Gray is associated with childhood memories with bricks and tiles, such as childhood scenes of romping in gray courtyards. When some space color awakens the old people to some old things, they hope to share these experiences with others more. Then, color indirectly promotes the communication among the old people to eliminate their loneliness and depression caused by age.

2.3. The dimensional visual effect of colour

The visual difference brought by the color light wave will also affect the feeling of space for the elderly. For example, as shown in Fig. 3, the same size of the space were sprayed into white, blue, red, due to the color value of the more heavy depressive will be more heavy, the white space in the visual effect will be greater than the other two spaces color. Therefore, color can play a role in adjusting the space scale, creating a greater visual effect in the limited space so that the elderly can reduce the tension and sense of pressure to create a relaxed space atmosphere.
Therefore, it can be seen that environmental color can directly and indirectly affect the physiological state and psychological activities of the elderly. Then, the next thing to be considered is the living environment that the elderly are more expected to live in the aging facilities. Through the use of color, their living state and mood can be changed to create a more comfortable living environment for the elderly.

3. The colour demand to the space of old people

As people grow older, they face two major problems: declining physical functioning and psychological emptiness. Therefore, the space color requirements of suitable aging facilities will be discussed from physiological and psychological aspects.

3.1. Physiological needs

What old people should face above all is the physiology problem that the function such as physical strength and mental power declines to bring gradually.

Visual acuity of the elderly is the ability to reduce object details [1], increase the contrast between object and background, and extend the observation time of the elderly can improve visual acuity. The color sensitivity of the elderly gradually weakened, color space easily mislead the elder's judgment and perception resulting in falls, collisions and other accidents; Memory loss also makes it easy for the elderly to get lost in nursing homes. Sensitivity and memory problems for optimal aging facilities facade, interior space and the identification of outdoor environment to have certain, with saturated lightness and taller lightness of the color separates between different functional areas and have priorities, and using the wavelength in the color of the more than 500 NM in order to increase the elderly to colorific susceptibility, which can be found in Fig 4. For example, in the traffic space, emergency evacuation exit position, alarm switch position with color key identification, help the elderly to strengthen the ability to identify, spatial memory and judgment ability. In addition, the attenuation of color sensitivity of the elderly will lead to more and more serious color confusion problems, so in the space color also need to ensure that the color type of restrictions.

In the treatment of a patient with cerebellar dysfunction, Goldstein found that red was more likely to cause dizziness than green [2]. The meeting after function of old people cerebellum decayed and patient are same lack balance feels, because this suits aging facility to should choose a few comfortable, gentle, quietly elegant color as far as possible, for example weak blue, weak green, cream-colored wait a moment, avoid too big visual impact.
Appetite is a key factor supporting the physical function of the elderly, especially those who suffer from pain often need some external stimulation to alleviate the psychological rejection of food. The results of the food contrast experiment with cool and warm colors show that warm colors can stimulate the production of taste buds and saliva, and make the elderly have more appetite, which can be found in Fig 5. This result can guide the color design of the dining or tea area in the nursing home with warm colors. Another reason for choosing warm color design is that warm color has a certain thermal effect. Old people are more afraid of cold than young people, and they need a long-term stable and mild indoor temperature to maintain their normal functioning. Therefore, the color selection will consider the color's heat absorption and reflectivity to determine. Also inversely related to aging is the quality of sleep in older people; less sleep as you get older and poorer sleep quality, which affects mental state and mood in older people. Because this decreases the change of colour as far as possible inside the living space of old people and collocation, the quietly elegant pure color that USES stable mood more undertakes deck.

3.2. Psychological demands
The second problem facing the elderly is the psychological problems caused by the spiritual emptiness. Young people who are busy with their career or go far away from home are the main factors for the generation of old people's sense of loss and loneliness. In addition, their peers are becoming less and less, and their social circles are getting smaller and smaller as they grow older. Old people tend to feel depressed in this indifferent environment. Age-appropriate facilities not only provide activities and services for the elderly, but more importantly, they can create a sense of family and belonging that the elderly need, that is a sense of humanity. It is very important to imitate and restore the original family situation and living atmosphere of the elderly through the matching of colors of suitable aging facilities, which directly affects the mood and the fun of life of the elderly. In addition, the colour of the elderly preference is also worthy of the architect to respect, most old people in the aging stage of seeking and ease easy-going psychological, tend to choose wavelengths longer color and cool color as your dress color, but the image of the word "Baby Elder" description of the desire for the bright colors in the heart of the world in the elderly, the elderly more old more hope to have angry, optimum aging facilities should choose according to the real taste of old people colorific collocation peace rather than seek comfort, is old age need more enthusiasm and vitality, is also one of the ways to ease the loss. Another feature of the aging facility that distinguishes it from the ordinary old-age residence is that it includes the function of healing. The elderly with physical diseases need a quiet rest and a bright and quiet rest space, but this is not inconsistent with fun and family belonging.

It can be seen from this that the color design of suitable aging facilities needs to be designed in different categories, and different functions of different groups need to be considered comprehensively rather than one-sided and stereotyped.

4. Design method of space color suitable for aging facilities
Combining the influence of color on the elderly and the reaction of color on the elder's physiology and psychology, this paper proposes a feasible method for the color design of suitable aging facilities, so as to enhance the elder's family sense of belonging and happiness index. The color design of the aging facility space includes the building facade, interior space and outdoor space environment.
4.1. Color of building facade
Before the design can be suitable for aging facilities built into two categories of urban and suburban to consider.

4.1.1. Suitable for aging facilities in the city. In the city, the facade color design should take the city as the design background, coordinate with the city style and texture, and take the building facade as the cultural carrier to spread regional culture. The users of appropriate aging facilities have certain particularities. In this city with different styles, appropriate aging facilities need to be identifiable to facilitate the elderly to remember their activities and living locations. The memory of the elderly will be more acute because of the external stimulation, and the more distinctive color is, the stronger the visual impact is, the more attractive it is, and the easier it will be remembered [3]. Therefore in the aging infrastructure in the facade design, can use simple modelling fill saturation, relatively high lightness and bright color, contrast and difference of stresses and the surrounding buildings, enhance the clarity of the construction instructions, at the same time also in remind citizens around the structure of the special function USES, limiting them too fierce some noisy entertainment activities, provide a better pension space for the elderly. Figure 6 shows Clichy-Batignolles Paris, for example, ecological nursing homes, the nursing home is located in the center of the block, the overall adopts coordinated with surrounding buildings like beige, location on the balcony spraying beautiful red, the balcony to blocks of different direction and the elderly to a nursing home in every perspective from the demarcation of numerous buildings, enhanced nursing homes can be identification for building itself and the city added vigor at the same time. And optimum aging facilities as part of the urban construction group, in building facades and roofs in different plant bright-coloured colour collocation as architectural decoration is desirable, this way not only enrich architectural color make the representative, signature, at the same time adjust the buildings around the city microclimate, even for building interior environment construction overall comfort, energy saving make a certain contribution.

![Figure 6. Appearance of Clichy-Batignolles ecological sanatorium in Paris](image)

4.1.2. Suitable for aging facilities in rural areas and other natural environment. The modeling and color design of such buildings should restore an ecological environmental state as much as possible and integrate with the surrounding environment. However, in consideration of the use of special groups, the color design should consider the identification of medical rescue, which should be appropriate to the natural environment and different. For example, as shown in Fig.7, the Orbec nursing home in the mountains of Normandy, France. In order to make the nursing home less obtuse and reduce visual impact, the architect used green elements to integrate the nursing home with the surrounding landscape, and at the same time reflect the rural natural atmosphere of the surrounding environment. White parapets, roof and bottom white walls create a sense of lightness and allow the building to be easily found in the valley.
4.2. Color of indoor space
The indoor space suitable for aging facilities is the most frequent space for activities of the elderly, including private bedrooms, public entertainment space, leisure space, dining space, medical space, traffic space, evacuation exit, etc. The characteristic that attenuates according to old people eyesight, sensitivity, memory, balance ability and demand, in indoor colorific whole design process, need will differentiate different functional space through colorific contrast, avoid colorific collocation too trivially at the same time. The contrast of color can be divided into warm and cold division, light and shade division and color division.

4.2.1. Residential space. Living space is a private space used by the elderly for a long time, which is full of their personal consciousness. The color design hopes to restore the warm life scene when the elderly are at home, but cool colors are easy to expand the original living space of one person, and cool colors are easy to make the elderly feel lonely and indifferent. Because this suits to use a few warm color to move in living space, high lightness, low saturation, Figure 8 shows that the color that is close to nature, the sunshine that shoots from transparent glass can enhance indoor brightness and saturation, give full play to colorific thermal effect, provide comfortable thermal environment for old people. Louvers are used on the Windows to shade the outdoor color through the louvers to produce a certain transparent effect, and also strengthen the privacy of the living space. At the same time the room as far as possible do not choose colorful wallpaper, this often will let the old people think of the hotel room, so as to produce a sense of estrangement weaken the sense of family belonging, trivial color collocation will also affect the elderly sleep. For example, the ecotype sanitarium in Paris is clad in a naturally warm wood material that wraps around the walls and floors near the Windows. As shown in Fig.9, when reflected by the sun, the warm yellow light will fill the room against the white wall, and the thermal effect will be relatively obvious.
4.2.2. Activity space. Activity space is a place for the elderly to drink tea, play chess, sing, paint and other recreational activities, in which the elder's heartbeat, blood pressure, adrenaline and so on will be increased due to the stimulation of activities. The choice of location color should help the elderly to maintain this stable activity state. Therefore, colors with excessive excited color or cool colors are not easy to use, and colors with low saturation are more appropriate, which can be found in Fig.10. The use of lively and jumping color points in the activity space to adjust the background color with low saturation can enhance the enthusiasm of the elderly to participate, shorten the sense of space distance, eliminate the strangeness of the elderly, and stimulate the desire for communication. In an interview with the family of an old man, she said: "originally, the old man had a piece of land at home where he could grow flowers and vegetables. Here she can also grow flowers and vegetables, which makes her feel more secure" [4]. Therefore, adding colorful plants in the activity space can imitate the living situation of the elderly at home, so that the elderly can have a sense of belonging and security.

![Figure 9. Sanatorium in Paris ecological district.](image)

![Figure 10. Main color of activity space and its decoration match color.](image)

4.2.3. Dining space. Dining space and old people appetite are contacted closely together. As shown in Fig.11, the scale of the dining space is scaled by bright and warm heavy colors. Hollowed-out materials are used to break the environment outside the dining space into the dining background, which can also be regarded as the hollowness of the background to avoid the open and empty dining space looking like a canteen. The family sweet atmosphere that colour builds also can stimulate the taste bud of old people. The desk and chair inside the space can choose sedate, the color that forms contrast with the space, enhance identification sex and safe sense.

![Figure 11. Main color of dining space and its decoration match color.](image)
4.2.4. **Traffic space.** Traffic space is an important space for evacuation. On the one hand, it is easy to identify and follow, and needs to be filled with color with high recognition. On the other hand, considering the psychological impact, it is necessary to choose colors that can comfort and calm the elderly in case of emergency, which can be found in Fig.12, so as to help the elderly make judgments and avoid vertigo. Figure 13 shows that the handrail colour in traffic space should distinguish with dimensional whole color come, the choice is for example: black, white the match colors with big difference of the color such as yellow, red etc.

![Figure 12. Main colors of traffic space and their decorative matching colors.](image1)

![Figure 13. Traffic space of Orbec nursing home, France.](image2)

4.3. **outdoor space environment**

Outdoor space environment color design can also be divided into urban and suburban two categories to consider.

4.3.1. **Suitable for aging facilities in the city.** Urban space is short of natural environment color, the elderly in the city will aspire to return to nature, so in the design of landscape with plant color as the main tone, each functional block placed the same plant so as to avoid excessive color so that the elderly produce visual confusion. At the same time, we should take the seasonal factors into consideration. We should choose plants that are mainly green all year round as the background color and plants that are open in turn in four seasons as the decoration color. Even in the cold winter, the elderly will have a warm feeling. In addition to landscape color design, there are paving color design square, shade path choose light color, pure color is different from green plants, at the same time to avoid losing direction; Seats, flower racks, garbage cans and so on can be set in the position of turning and the end of the road with bright colors, suggesting that the elderly can slow down their walking speed. As shown in Fig.14, HOSPER's Zonnehuis retirement home has created a vibrant green pedestrian area on the public ground to provide a high-quality green space for the elderly in the city to enhance their living experience.
Figure 14. Zonnehuis nursing home in amstelfen.

4.3.2. Suitable for aging facilities in rural areas and other natural environment. Suburban nursing home itself is placed in the self-heating environment, with the distant mountain prospect as the main object of appreciation. Use gray, brick red, dark wood color to wait a moment to glance the color with low effect, bigger absorbing quantity of heat, won't produce glare glance to affect old people to appreciate natural scenery on the one hand, brunet can have better thermal effect on the other hand, increase outdoor easy measurable, facilitate old people to go out activity.

5. Conclusion
At present, there is still a lot of research space for building color in China, especially for the aging facility. In the appropriate aging facilities color design:
- Pay attention to the symbolic meaning of color, consider the psychological implications of color for the elderly and the elderly in the face of color physiological behavior reaction;
- Consider the elderly vision, memory, sensitivity changes, through color saturation, brightness, hue wavelength and other key areas and division of functional space;
- The building elevation color design considers the city and the suburb region characteristic and the identification;
- The interior space color design according to the different use function characteristic to build the suitable atmosphere;
- Outdoor environment color design pays attention to the seasonal adaptability of plant collocation and the signage of pavement and auxiliary facilities;

Through the study of the influence of color on the elderly and the color needs of the elderly, the color environment of suitable aging facilities can be adjusted based on color factors. On the one hand, it can make more contributions to the high-quality life of the elderly in their later years; on the other hand, it can improve the service performance and safety performance of suitable aging facilities.

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