Original Research Article

Analysis of the impact of visual preferences of the elderly on interface color design

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Abstract: With the advent of an aging society, the elderly have become an important user group of digital products. Their visual preferences have a significant impact on interface color design, which is not only related to the improvement of user experience but also to meeting their physiological needs and emotional communication. This paper analyzes the importance of the visual preferences of the elderly on interface color design and discusses the influence of hue selection, lightness contrast, saturation application, and color combination on the interface used by the elderly. The research results show that reasonable color design can significantly improve the use experience of the elderly and enhance the readability and attractiveness of the interface.

Keywords: Elderly; Visual preference; Interface color design

1. Introduction

With the intensification of global population aging, the elderly group is continuously increasing in proportion in society, and their demand for digital products is growing. However, the visual system of the elderly will deteriorate with age, such as reduced contrast sensitivity and weakened color discrimination ability. These changes pose new challenges to interface color design. Good interface color design can not only improve the use experience of the elderly but also help them better understand and operate digital devices, thereby improving the quality of life. Therefore, studying the visual preferences of the elderly and their impact on interface color design is of great significance for designing interfaces that better meet the needs of the elderly.

2. The importance of visual preferences of the elderly on interface color design

2.1. Improving user experience

The visual function of the elderly declines, and their color sensitivity and recognition are different from those of young people. Interface color design that takes into account their visual preferences can greatly improve the user experience. Appropriate color combinations can make it easier for the elderly to recognize interface information and operating functions. For example, distinct but not overly dazzling contrasting color combinations can be used to distinguish important elements from the background, making the interface hierarchical and facilitating their browsing and interaction. A light and gentle tone can create a comfortable atmosphere and relieve visual fatigue. From a visual psychological perspective, familiar and aesthetically pleasing colors will make the elderly feel more intimacy and security when using the interface, thereby increasing product acceptance and frequency of use and improving the overall user experience.

2.2. Meeting physiological needs

The eye lens of the elderly is yellowish and turbid, and there are fewer retinal cells. Color perception

changes with age. Physiologically, designing interface colors according to their visual preferences is crucial. Studies have shown that the elderly have a relatively high recognition degree for warm tones such as orange and yellow. Reasonably applying them to interface design as key information prompt colors can help the elderly quickly capture important information. Moreover, because the sensitivity of visual contrast will decrease, color combinations with high contrast should be used. For example, black text on a white background. However, it should be noted to avoid strong reflections that stimulate the eyes. When lighting conditions are met, the brightness of colors should not be too high to prevent visual fatigue. For example, for some medical and health interfaces, for the elderly user group, adopting a distinct and easily recognizable color system can enable them to accurately read and understand data, which is conducive to meeting their physiological needs for receiving information and making the operation process more smooth and comfortable.

2.3. Color has emotional communication function

Color itself has a strong emotional communication function, especially for the elderly. Warm and gentle colors, such as beige and light blue, often give them an emotional experience of tranquility and reassurance. Incorporating colors that meet the visual preferences of the elderly into interface color design can convey positive emotions. For example, using warm colors in the interface of social software can make the elderly feel care and companionship and increase their willingness to use it. At the same time, different color combinations will also affect the mood of the elderly. Bright color combinations can stimulate the energy and enthusiasm of the elderly. Moreover, colors with cultural significance also have special emotional connotations for the elderly group. For example, the festive and auspicious symbol of Chinese red and the application of red color systems on some festival-themed interfaces can arouse their emotional resonance and make it easier for them to integrate and accept related products or services. Therefore, paying attention to color design that takes into account the visual preferences of the elderly is of great significance for emotional communication.

3. The impact of visual preferences of the elderly on interface color design

3.1. The influence of hue selection

Hue plays a crucial role in color design and is of even greater significance for the color design of interfaces for the elderly. Due to changes in physiological functions, the hue perception and preferences of the elderly are completely different from those of young people. In terms of visual sensitivity, the function of cone cells in the eyes will decline with age, and the sensitivity to cool colors such as blue and purple will also decrease. Therefore, in interface design, excessive use of cool colors, especially darker cool tones, will make it difficult for the elderly to recognize interface elements. For example, a dark blue button may seem clear and conspicuous to young people, but it is easily confused with the background for the elderly. In contrast, they are more inclined to recognize warm colors such as red, orange, and yellow. Red has a strong visual impact. Applying it to some emergency prompts or signs with important functions can quickly attract the attention of the elderly. For example, on the interface of health monitoring software, red can be used to highlight abnormal data so that the elderly can detect it in time. At the same time, the impression and perception of hue by the elderly will also affect interface design. They usually like some traditional and familiar hues. For example, green is a symbol of vitality and nature in the minds of many elderly people. Applying green tones to interfaces related to health preservation and gardening can make the elderly feel a sense of intimacy. In addition, when it comes to hue combinations, the visual feelings of the elderly should also be taken into account. Complicated combinations with high contrast and

large differences in hue can easily cause visual fatigue and discomfort. Harmonious and natural hue combinations should be used. For example, using orange as the base tone and a light beige as the auxiliary color not only highlights the key points but also creates a pleasant visual atmosphere. From a cultural perspective, different hues have different meanings in the hearts of the elderly in different regions and cultural backgrounds. In traditional Chinese culture, gold and yellow have the meanings of nobility and auspiciousness. In some interfaces with traditional cultural elements for the elderly, appropriate use of gold or yellow elements can enhance their sense of identity and belonging. In addition, hue selection according to the living scenes and needs of the elderly is also crucial. For elderly education interfaces, elegant pink series and other mild hues can create a relaxed learning atmosphere.

3.2. The influence of lightness contrast

Lightness contrast plays a decisive role in the color design of interfaces for the elderly. The visual system of the elderly will undergo many changes during aging, and these changes make lightness contrast of profound significance in the process of obtaining interface information. Physiologically in visual perception, the lens of the elderly will gradually become cloudy, and the scattering of light passing through the lens will increase, resulting in a reduction in the clarity of retinal imaging. Therefore, in interface design, high lightness contrast in color combinations can help them distinguish different elements more clearly. For example, white text on a black background is more convenient for the elderly to see. This is because strong lightness contrast can enhance visual signals, enabling accurate capture of information even when vision declines. In some news reading application interfaces, if words with low lightness contrast, such as light gray words on a beige background, are used, the elderly are very likely to abandon it because they cannot see clearly. However, lightness contrast is not stronger the higher it is. Excessive lightness contrast can cause a dazzling visual effect and make the elderly's eyes uncomfortable. Especially in strong light environments, excessive lightness contrast will increase eye fatigue. Therefore, comfort should be considered in design. For example, in some interfaces used in outdoor scenarios, although a certain degree of lightness contrast is needed to ensure readability, the contrast intensity can be appropriately reduced and soft colors can be selected to relieve visual stimulation. At the same time, different functional areas of the interface also need to use lightness contrast reasonably according to the importance. Important operation buttons or key information can be highlighted in high lightness contrast, and some auxiliary elements can be used in relatively low lightness contrast. This can not only ensure the sense of hierarchy of the interface but also not cause visual confusion for the elderly. From a psychological perspective, high-lightness colors often give people a positive and relaxed experience, while low-lightness colors may give people a stable and tranquil feeling. For interface design for the elderly, lightness contrast should be adjusted according to the usage scenario and the psychological expectations of the target audience. For example, in leisure and entertainment interfaces, the lightness of colors can be appropriately increased to create a lively and cheerful atmosphere; and in medical and health interfaces, in order to give the elderly a sense of trust and security, the use of lightness contrast can be more stable. Avoid overly flashy and jumpy color combinations. In addition, the adaptability of the elderly to light decreases with age. Excessive lightness contrast at night or in low-light environments may damage the eyes. Therefore, interface design should have the characteristics of adjustable lightness contrast or automatic adjustment according to ambient light so as to meet the needs of the elderly for various lighting conditions.

3.3. The influence of saturation application

The influence of saturation on the color design of interfaces for the elderly cannot be ignored. Saturation refers to the vividness of colors and has many influences on the visual experience and interface understanding of the elderly. Physiologically, the visual cell function of the elderly's eyes declines. Colors with too high saturation are easy to cause visual stimulation to their eyes and lead to visual fatigue and even discomfort. For example, when overly bright fluorescent colors are applied on a large scale on the interface, the elderly will feel dazzling and find it difficult to stare at the screen for a long time. On the contrary, colors with lower saturation are relatively mild and more in line with the gradually weakening tolerance of the elderly's vision. For example, some elegant Morandi color systems and low-saturation color combinations create a quiet and comfortable visual feeling and are suitable for interfaces commonly used by the elderly for health preservation and reading. The application of saturation in information transmission is also very crucial. Appropriate increase in the saturation of the colors of key information parts can attract the attention of the elderly. Taking shopping interfaces as an example, using a color with slightly higher saturation for the "purchase" button and contrasting it with the surrounding background and text with lower saturation can enable the elderly to find and recognize it faster. However, it should also be noted whether the overall saturation is harmonious. If the saturation difference between various elements is too large, the interface will look messy and increase the cognitive burden of the elderly. From an emotional perspective, colors with different saturations can induce different emotional responses in the elderly. High-saturation colors are usually full of vitality and passion, but for the elderly who seek peace and tranquility, they may be too noisy. Low-saturation warm colors such as light pink and light yellow can convey a warm and comfortable feeling, which is conducive to creating a friendly interface atmosphere and improving the elderly's favorability for the interface. On social application interfaces, using low-saturation colors to design chat backgrounds and other elements can make the elderly feel relaxed and happy when communicating. In addition, cultural background will affect the elderly's preference for color saturation. In some regions with strong traditional color cultures, the elderly may prefer saturation with national characteristics. Taking some areas in China as an example, although the saturation of bright red is relatively high, when it is used in festivals or interfaces related to festivities, it can arouse the elderly's sense of cultural identity and belonging. And in some international applications, the acceptance of saturation by the elderly from different cultural backgrounds needs to be considered, and colors should be used in a balanced way to ensure that the interface color design can simultaneously meet functional needs and the visual preferences and emotional needs of the elderly.

3.4. The influence of color combination

Color combination plays an extremely crucial role in the color design of interfaces for the elderly and deeply affects the elderly's understanding, operation, and emotional experience of the interface. In terms of visual cognition, reasonable color matching is conducive to improving the recognition of interface information. The visual function of the elderly declines. Complicated and messy color combinations will make it difficult for them to quickly and accurately obtain information. For example, the combination of complementary colors such as red and green, if not properly matched and the area ratio is not coordinated and the saturation is very high, it will cause a strong visual conflict, making it difficult for the elderly to focus on important things. On the contrary, using combinations of similar colors, such as the combination of light blue and dark blue, combined

with appropriate changes in lightness, can create a harmonious and rich visual effect. For elderly education APPs, for example, the main text is mainly in dark blue, and the background or decorative elements are mainly in light blue. This can be clearly distinguished and will not cause visual discomfort. From the perspective of meeting the emotional needs of the elderly, color combinations have functions such as conveying emotions and creating an atmosphere. Warm colors such as orange and yellow combined with gentle beige and off-white can give people a warm and comfortable feeling and are suitable for interface designs such as elderly social interaction or family care. This color combination seems to convey a sense of care and companionship, making the elderly feel more intimate when using it. Moreover, cool and warm colors can be carefully coordinated. For example, the combination of light blue and light pink can create a fresh, tranquil and vivid atmosphere. In some applications for cultivating elderly interests, it is conducive to stimulating the hobbies and positive emotions of the elderly. At the same time, differences in cognitive of the elderly from different cultural backgrounds should also be considered in color combinations. In some Western cultures, purple is often regarded as a symbol of nobility and mystery, while in some Asian cultures, it does not have such a strong meaning. Therefore, for elderly users from different cultural backgrounds, caution should be exercised in choosing color combinations. For example, in the process of designing health management software for elderly users around the world, if a large number of color combinations with specific cultural meanings that are not widely understood are used, it may cause confusion or resistance in some users. In terms of operational convenience, color combinations can distinguish different functional modules. For example, in elderly financial APPs, dark green can be used to represent savings-related functions, and light green can be used to represent wealth management functions. Through the combination of different shades of colors, the elderly can intuitively distinguish different business sections and reduce the error rate of operations. Moreover, the consistency and coordination of color combinations are also helpful for the visual memory of the elderly. If the color combination styles of various interfaces are consistent, the elderly can quickly adapt and become familiar with the operation process after multiple uses, and increase their trust and dependence on the product. In addition, color combinations for different usage scenarios need to be adjusted accordingly. In the daytime when there is good lighting, the color combination can be appropriately rich and bright; and at night or in low-light environments, low-contrast and soft color combinations should be used to reduce eye stimulation and ensure the comfort of the elderly when using the interface.

4. Conclusions

In summary, the visual preferences of the elderly have a profound impact on interface color design. Designers should fully consider the visual characteristics of the elderly when designing interfaces and select appropriate hues, lightness, saturation, and color combinations to ensure that the designed interface is both beautiful and practical. By optimizing color design, the use experience of the elderly can be effectively improved, helping them better integrate into digital life and enjoy the convenience brought by technology. In the future, with the deepening of research and the development of technology, we are expected to see more interface designs tailored for the elderly, so that technology can truly serve users of every age group.

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Project

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