Designing an Intelligent Mobile Application for Catering to the Social Needs of Older Adult Individuals

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Abstract

Confronted with the increasingly pressing issue of population aging, the construction of an elderly-friendly society has become an urgent priority. With the rapid development of information media and urbanization, social isolation among "empty nest" elderly individuals has become a prominent feature of aging in China. This study conducted field surveys and systematic analyses to understand the social needs of elderly individuals within the digital information context, focusing on intergenerational communication, interpersonal relationships, and social participation. Based on these findings, the researchers proposed a shift in the design thinking of smartphone APPs from a "tool-oriented" approach to a "humanistic context" approach, reexamining the inherent logical relationship between design, target audience, and society. From the perspectives of typography, color, and functionality, the design of the intelligent smartphone app was explored, offering a positive response and exploration in the pursuit of constructing an elderly-friendly society.

Keywords: *Elderly Individuals; Social Needs, App Design; Intergenerational,   Interpersonal Relationship,   Participation in Social Activities.*

Introduction

The digital landscape has significantly transformed the lifestyle of elderly individuals. Digital shopping, digital transportation, and digital healthcare have become crucial factors influencing their quality of life. It is evident that this shift primarily focuses on the individual needs of the elderly. Therefore, it is of great urgency and value to construct a spatial context that caters to the living needs of the elderly. According to a sampling survey conducted by the Kue User Research Institute, "social needs rank first among the daily needs of the elderly" [1]. From a sociological perspective, rapid urbanization in China has led to a brain drain effect in cities. Faced with career choices, development opportunities, and life pressures, more and more young people are migrating from rural areas to large cities. This migration has resulted in a significant population of empty nesters. "Social interaction activities tend to decrease, which can easily lead to feelings of loneliness." [2]Prolonged solitude experienced by these elderly individuals has led to psychological disorders, making empty-nest syndrome a societal issue. With the widespread adoption of 5G mobile networks, smartphone APPs facilitating social interactions have become essential channels for emotional communication between the elderly and their loved ones and friends. These APPs hold significant value in alleviating the loneliness caused by empty nesters, helping them find a sense of belonging and happiness within their families.

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"The use of social media provides a low-cost and easily accessible means of communication,with the potential to reduce loneliness among the elderly."[3]However, the social-oriented smartphone APPs available in the market are predominantly comprehensive service-based and primarily focused on consumer-level products such as WeChat and QQ. These products are not specifically tailored to the needs of the elderly, putting them in a passive position. In December 2022, China Youth Daily(https://www.youth.cn/) reported, "The most common issues encountered by elderly consumers in using smartphone APPs are small font size, experienced by 58.1% of respondents; excessive advertisements, encountered by 54.8% of respondents; difficulties in closing pop-ups (40.4%); complex user interfaces (39.7%); and difficulties in operation (35%)." "In light of the requirements of human-centered development, the needs of the elderly population for smart communication products should be given due attention, and society should adequately prepare and implement 'age-friendly' adaptations for intelligent media" [4]. This clearly demonstrates the immediate urgency and contemporary significance of conducting research on smartphone APPs that cater to the social needs of the elderly population.

Characteristics of Social Needs in the Elderly Population

From a biological perspective, humans are inherently social creatures and cannot exist independently outside of a collective framework. "The use of social media and the sharing of health information are most closely related to the physical and mental health of the elderly"[5]. In light of this, this study integrates attachment theory to delve into the research, defining attachment as "the emotional bond between individuals and specific others, where the individual harbors profound feelings for these others and seeks their presence" [6]. In order to accurately comprehend the social needs and behaviors of the elderly, this research aims to gather social discourse and behavioral information. For this purpose, the study focuses on the elderly population in the Zhumingshan community of a certain city, collecting firsthand data through on-site investigations and interviews, which are subsequently organized and analyzed. Considering the convenience of interviews, these discussions were concentrated within the Zhumingshan community and were territorially divided among the Chenjiawan, Xiongjiawan, and Shanshuwan districts, as well as the residential areas of Ruitian New City, Hongbo Garden, Jintai International, the university faculty living area, and other functional residential areas. The interviews targeted individuals between the ages of 60 and 79 who reside at home (as indicated in Table 1) and who were in good mental condition, capable of understanding the questionnaire and providing responses. This approach ensures the reliability of the questionnaire data, rendering it suitable for analytical research.

Table 1: Sample Selection Information.

Type	Original residence	Residential community	Workplace residential	Functional residential
Residential areas	Chenjiawan, Xiongjiawan, Shanshuwan	Ruitian New City, Hongbo Garden, Jintai International	University faculty living area	Retail, dining, student street

Social needs of the elderly

To comprehensively understand the social needs of the elderly and conduct in-depth interviews, the interviewees primarily consist of two categories: community staff and the elderly population.

Interview with Community Staff

The interview with community staff revolves around the social situation, social needs, social media usage, purposes, reasons, and challenges related to the socialization of the elderly (as shown in Table 2).

Table 2: Interview With Community Staff.

Interviewees	Interview Content
Community staff	1. What is the current social situation of elderly in the community?
	2. How are the elderly individuals faring in terms of intergenerational relationships, interpersonal communication, and social participation?
	3. What is the current usage of social networking APPs on smartphones among elderly individuals in the community?
	4. What are the purposes for which elderly individuals use social networking APPs on smartphones to communicate?
	5. What are the most common challenges faced by elderly individuals when using social networking APPs on smartphones for socialization?

Before conducting interviews with the staff of the community elderly service center, it is important to prepare an interview script. Given the unique nature of their work, it is recommended to conduct two semi-structured interviews, each lasting approximately 20 minutes. Additionally, taking into account the sensitive nature of the interview topics, some questions may require a more indirect approach to eliciting opinions. Therefore, during interviews with relevant personnel, a conversational style of expression was employed, based on the interview script. The following text is organized based on the interview content:

Firstly, regarding the current social situation of the elderly in the community, community staff members believe that there has been a significant shift in their living patterns. The traditional family structure, centered around the elderly, has evolved into smaller family units centered around younger generations. These structures exist side by side. This shift is primarily due to the separation of parents and children, which has become a common way of life. However, this has led to the emergence of "empty nest" situations among the elderly, making their emotional need for care and attention from their children, grandchildren, and others more pressing. Due to the geographical distance between them, daily communication and emotional connection are often facilitated through social networking applications on smartphones. Therefore, it is evident that social networking APPs on smartphones are playing an increasingly important role in facilitating social interaction within "empty nest" families. The desire for intergenerational communication among the elderly is universal and strong.

Secondly, how are the elderly individuals faring in terms of intergenerational relationships, interpersonal communication, and social participation? Based on the information obtained, social interactions for the elderly in the community mainly involve three aspects. The first aspect is family members, namely, spouses, children, and grandchildren. These are the closest and most easily accessible interpersonal relationships for the elderly. How these relationships are managed directly impacts their quality of life and sense of happiness in their later years. The second aspect is communication with colleagues or friends. After retiring, the elderly have reduced contact with colleagues and work associates. However, through smartphone social networking APPs, they engage in communication and interaction through voice messages, interactive media, video calls,

and other means. This form of communication not only deepens emotional connections but also broadens their horizons and increases their understanding of modern society. The third aspect is the elderly's participation in social activities to expand their social circles. Many elderly individuals possess valuable expertise and may even be experts in relevant fields. Among them, there is a strong willingness to engage in social service activities. By participating in such activities, they can meet peers, exchange interests and experiences, and ultimately enhance their quality of life.

Considering the backdrop of population aging, it is urgent and valuable to establish meaningful interactions between the elderly and their families, friends, and society. This will allow them to showcase their relevance in the modern era and improve their overall quality of life.

Thirdly, what is the current usage of social networking APPs on smartphones among elderly individuals in the community? Currently, the majority of elderly individuals are using smartphones, while a small portion still use feature phones due to lower education levels or economic reasons. Among those who use smartphones, the most frequently downloaded and used APPs include WeChat, TikTok, AAuto Quicker, Pinduoduo, and Square Dance. The primary functions they use revolve around social communication, short video consumption, news reading, and entertainment. The purposes of elderly individuals using smartphone APPs for communication are as follows: firstly, maintaining familial connections. They use APPs such as WeChat and various group chats to facilitate communication and interaction with their children, family members, colleagues, and friends. Secondly, they use these APPs to fulfill their social and entertainment needs, including activities such as entertainment and reading. This helps improve their quality of life, pass time, alleviate feelings of loneliness, and relax. Lastly, they also engage in digital social activities, such as electronic payments, online shopping, and making appointments.

The most common difficulties encountered by elderly individuals when using smartphone APPs are primarily related to small font sizes in app interfaces, excessive advertisements, and frequent pop-ups. They may find it challenging to understand the functions of the pop-ups and the overall complexity of app operations.

During interviews with community staff members, the author focused on understanding the current social situation, needs, and behaviors of the elderly, summarizing their characteristics. These can be mainly categorized into three aspects: Firstly, the social needs of the elderly hold significant importance in their lives, and the issues they face are universal. Secondly, social networking APPs on smartphones have become an important means of social interaction for the elderly. Thirdly, the existing social APPs on smartphones are not age-specific, as they lack segmentation based on age groups, resulting in various challenges. There is a scarcity of APPs specifically designed for the elderly.

Interviewing Elderly Individuals

To gain in-depth insights into the real-life usage of smartphones for social interaction among the elderly, the researcher conducted in-depth interviews with representative elderly users who exhibited characteristic features of smartphone app usage (as shown in Table 3). These interviews were conducted on a one-on-one basis within the participants' living environments to understand their views, behaviors, and needs regarding residential settings, familial connections, participation in social activities, intergenerational communication, interpersonal interactions, and demands. It was important to take into consideration the physical condition and clear thinking of the elderly interviewees, and the interviews were conducted for a duration of 30-40 minutes.

Table 3: Exemplary Profiles of Individuals (Compiled by the Author).

oExemplary profiles of individuals		
	Personal Profile	Objectives of Elderly Users
Basic Information Name:Tian Shuangrong Family Situation: Living with children and spouse Education: Junior high school level	Family Structure: Tian Shuangrong has four offspring, with two daughters who have already married and are currently residing in Tianjin and Shandong, respectively. Tian Shuangrong and her spouse live together with their two sons in the bustling urban area of Huanggang. Presently, they take on the delightful responsibility of caring for their beloved grandchildren. However, there are occasions when a deep longing arises for their two daughters, as well as their relatives and friends. To bridge the distance, Tian Shuangrong relies on the WeChat to communicate with them. Hobbies: Watching videos on the smartphone, going for walks, and cooking. Phone Brand: Huawei Nova 8 smartphone. Phone Functions: Making calls, using WeChat, and watching videos on Douyin (TikTok). Physical Condition: In good health, with mild presbyopia being their only affliction. Frequent Places: Home, school, the local market, supermarket, and the community square. Social activities primarily take place at home and the nearby square, with communication with their daughters, relatives, and friends relying on phone calls or WeChat video calls.	Ease of communication with family members, relatives, and friends. Convenient access to weather forecasts. Watching short videos to enhance the enjoyment of life. Sharing personal life updates and achievements.

The user role model construction is aimed at gaining a clearer understanding of the social behaviors and motivations of older individuals. This allows for a more precise analysis of their social needs, thereby avoiding time wastage. Moreover, this process enables the continuous discovery of new social needs and pain points specific to elderly individuals, as depicted in Table 4.

Table 4: Interviewees' Lifestyle.

Living situation Description	
Living Situation	Residing together with her spouse
Social circle and mode of interaction	Children (face-to-face interactions, Smartphone Social APPs like WeChat), Friends (Since they moved to the city with their son, most of their friends and relatives are not nearby. They primarily communicate through smartphone social APPs. They make new friends through face-to-face interactions, and often share information through social APPs.
Scope of activities	Activities at home, neighborhood, parks, squares, and nearby malls
Daily activities	Taking care of grandchildren, browsing the phone for videos, taking walks, cooking, etc.
Life expectations	They have emotional communication and interaction with their children and grandchildren, allowing them to stay updated on their well-being and receive their care. They can also connect and show concern through the WeChat social app, as well as engage in heartfelt conversations with friends.

Through interviews, we have gained insights into the social views, behaviors, culture, and lifestyle of elderly individuals. This has helped us understand their social needs, current situation, and motivations. Elderly individuals' social activities primarily manifest in three areas: intergenerational emotional expression, interpersonal communication, and participation in social activities. Table 5 summarizes these areas.

Table 5: Elderly Individuals' Social Activities.

Social activities	Social interactions
Intergenerational emotional expression	Emotional socializing with children, grandchildren
Interpersonal communication	Interacting within the family circle, circle of friends, and colleagues
Participation in social activities	Engaging in social interactions based on shared interests, daily life experiences, and knowledge

Research suggests,"Strong willingness to touch the internet".[7].that the current social needs of elderly individuals are not adequately met. In the social model for the elderly, they are considered the dependent party, with attachment figures primarily including their children, relatives, friends, social workers, and other individuals. The main driving force behind these relationships is emotional connection or the psychological inclination to seek closeness with another person for a sense of security. "The meaning of products has evolved from a single functional entity to problem-solving solutions" [8].

Designing an APP for Meeting the Social Needs of Elderly Individuals

The need to reassess and design from a "user-centric" perspective. [9] In designing a smartphone APP for meeting the social needs of elderly individuals, three core elements—text, color, and functionality—play a crucial role. The combination and rational utilization of these elements directly affect the user experience and the acquisition of information. The focus of this study is on elderly individuals whose sensory organs begin to decline as they age. Their abilities to recognize colors, fonts, and sensitivity to sound and touch vary to a certain extent. Dr. Huang Zhaoming and his team from East China Normal University conducted research on the perceptual abilities of elderly individuals, revealing that "individuals aged 60 and above experience degenerative changes in their perceptual systems, particularly evident in visual and auditory impairments, which affect their reception of information from the surrounding environment" [10]. Therefore, the interface design of the smartphone APP in this study adopts a principle of closeness, respecting the physiological characteristics of elderly individuals and emphasizing the integration of visual elements and effective functional information.

Font design of the APP

(1) Font size and hierarchy in app design

"When designing an interface, it is important to consider the coordination between text style, background color, icons, and other combinations".[11] The current trend in smartphone APP interface design often utilizes boldface. This is because boldfaces are sans-serif fonts, possess evenly distributed strokes, ensuring clear visibility to a certain extent. They aid in users' visual recognition and are compatible with the zoom-in and zoom-out functionality commonly found in smartphone APP interfaces. In contrast, traditional serif fonts, with varying stroke widths at the corners, can result in dashed lines when using the interface's zoom-out function. This undoubtedly increases the difficulty of user recognition. Particularly for elderly individuals with weakened visual acuity, this not only affects their confidence and enthusiasm in using the APP but also leads to visual fatigue and psychological distress.

Based on these considerations and the principle of visual closeness, the preferred font for APP interface design is a clear and easily recognizable boldface. By utilizing boldface fonts, the typography becomes more prominent and conspicuous, facilitating recognition for elderly users.

As the aging process takes its toll on vision, the phenomenon of presbyopia emerges, making it difficult for older individuals to read small text. To address this, mobile APPs should adjust font sizes accordingly. For elderly users, the optimal range for font size lies between 17-20PX. "From a comfort standpoint, 17PX is deemed suitable, while older users find 20PX to be clearer, despite the appearance of dashed lines at the stroke intersections". [12] Therefore, in this design, the main body text should be no smaller than 18 dp/pt. Simultaneously, the line spacing should be increased proportionately, 1.3 times the font size. For IOS, the Chinese font used is sans-serif PingFang, while the English and numerical characters are set in the DIn font. The font sizes are organized in even increments, such as 18px, 20px, 24px, 28px, 32px, etc., creating a gradient for a more user-friendly smartphone APP interface design tailored to the elderly user base.

Furthermore, in APP design, text editing plays a role similar to that of iconography, effectively grouping and presenting elements on the page in a clear and intuitive manner by employing different font sizes, colors, and weights. To achieve this, the design solution establishes a visual hierarchy for fonts, dividing them into three main categories: main titles, subheadings, and body text. Each hierarchy and category determines the font size, as outlined below:

18px: Used for supplementary text (explanatory content).
20px: Applied for body text (regular text on the page).
24px: Reserved for headings (smaller titles within the page).
28px: Utilized for major titles (important large titles).
32px: Designated for significant numbers (followers, likes, activity).

Color Design

Color, as an essential means of human perception, can have a significant impact on our psychological state through contrast and hue differences. When designing smartphone APP interfaces, it is crucial to respect the diverse target audience and tailor the color scheme accordingly. Considering the elderly user demographic, they tend to be more sensitive to colors such as yellow, red, orange, and brighter shades of blue. Thus, in this research on APP color design, colors are modularly organized into several categories: primary color, secondary color, accent color, and warning color. The primary color refers to the overall color style of the mobile APP interface and holds a dominant position. It encompasses elements like the title bar, navigation bar, and tab bar. The secondary color category includes color blocks, icon colors, secondary heading colors, and embellishments.

"The emotional design of color in mobile APP interfaces plays a crucial role in enhancing the user experience". [13] For the homepage design of the APP, a white background color is chosen, while headers, functionalities, and modules are presented in orange. This combination effectively guides the attention of elderly users to the designated functional icons, enhancing their visual focus. The overall style is vibrant and stylish, providing a more intuitive way to grasp information. Additionally, the use of large white areas arranged neatly delivers a clean and concise visual effect for elderly users, reducing visual fatigue. Moreover, color differentiation is employed to distinguish different functional areas, achieving a harmonious balance between the overall and local components.

Flat Design Style

"Images have become an important carrier of visual language information in mobile app design". [14]Flat design is a simplified and distilled design approach that adheres to the principle of removing complexity and emphasizing simplicity. "It discards the realistic effects of gradients, shadows, and highlights, resulting in a visually 'flat' appearance". [15] "The application of flat design style in mobile APP thematic design can

effectively enhance the design outcome and significantly improve user satisfaction." [16] This design approach highlights the content itself, enhancing the audience's efficiency in identifying information and reducing cognitive barriers. Simultaneously, this design style promotes aesthetic appeal and simplicity in the interface, emphasizing the primary requirement of addressing the social needs of elderly users. By minimizing decorative elements, this design style aligns with the physiological and behavioral habits of elderly users.

"Flat style illustrations enrich the artistic form of mobile app interface design."[17]Considering the difficulties that elderly users may face in text recognition, the design of APP landing page incorporates both textual information and graphic elements. The graphic design emphasizes a sense of amusement, employing a cartoon illustration art style. The characters depicted are smiling with lively gestures, infusing the visuals with a sense of everyday delight that resonates with the elderly audience.so that the round corner rectangle might be the answer for the shape of the button.[18]This study focuses more on circular shapes in graphic design.

Functional Design

"In an aging society, the goal is not simply to prolong life, but to enhance the quality of life." [19] In order to meet the social needs of elderly individuals regarding intergenerational relationships, interpersonal connections, and participation in social activities, this study explores three levels of functional design. Firstly, in the core area of the APP's homepage, we have incorporated the "Happy Family" social module. This allows elderly individuals to easily identify information about their family members, enabling them to access profiles, photos, chat records, and other relevant data of their children and grandchildren. This feature aims to cater to the physiological and intergenerational communication needs of older users, "Using new touchpoints as media and tools to collect new information and lay the foundation for dynamic services."[20]Secondly, an independent page for interpersonal communication has been established, with added features such as likes, Q&A, and assistance. Channels for displaying information such as followers, attention, and activities have also been included. These enhancements effectively enhance interaction with friends, increasing the interest of elderly individuals in socializing with their peers, thereby improving user engagement and overall experience. Lastly, a dedicated page for social activity participation has been designed. This includes intelligent recommendations that suggest nearby community activities, reducing the inconvenience for elderly individuals when engaging in activities. To ensure clear understanding of activities, a combination of simplified post information and visual aids has been employed, making it easier for older users to grasp the content and reducing the reading difficulty for them. At the operational level, to facilitate one-click searching for desired activity information, a search button has been provided, enabling hierarchical management and categorization of activities into three levels: recreational activities, fitness activities, and cultural activities. This makes it more convenient for elderly individuals to browse and select activities they would like to participate in. In order to keep older users and their families informed about the progress of activities, a segmented selector has been implemented, categorizing activities into three types: available for registration, ongoing, and finished. This helps elderly individuals filter out activities in which they can participate. Furthermore, emphasis has been placed on the recognition of key activity information, including the activity name, organizer, date, location, and capacity. To aid in this recognition, distinct button styles and levels have been designed, utilizing ghost buttons to differentiate them from primary buttons. Additionally, an inclusion of activity guidelines helps prevent elderly individuals from selecting the wrong activities, reducing unnecessary issues and minimizing operational errors and comprehension difficulties. This also effectively enhances the security of social information

for elderly individuals, safeguarding against deceptive messages.

Conclusion

Looking at mobile APP products, it is evident that social issues among the elderly have garnered societal attention, yet they have not achieved universal recognition, lacking relevant theories and targeted social products. With market and societal demands, addressing intergenerational, interpersonal, and social participation-related issues in elderly social APPs is bound to attract widespread attention and prompt social contemplation. Research on elderly social APPs is sure to delve deeper and become more systematic as society continues to age. Firstly, product design should depart from a "technological context" and embrace a new dimension of social livelihood for innovative design and societal value,. Secondly, elderly social APPs are poised to exhibit group delineations, presenting intelligent choices based on the focal points of elderly social needs, thus demonstrating a trend toward habitual intelligence. Lastly, the design will break down perspectives of marginalized groups, approaching the elderly with a stance of respect and equality, providing deeper humanistic care and contemplation.

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