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Toward a Metaverse Era: a Study on the Design of Smart Home Entertainment Scene Experience for Empty-Nest Youth

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ABSTRACT

In order to explore the changes and development of smart home entertainment scene experience design in the metaverse perspective, this paper takes empty-nest (EN) youth experience design as the research object, analyzes the needs of EN youth in home smart scenes, and studies the trend of smart home experience design for EN youth. Taking the smart home entertainment scene as an example, this paper uses the meta-universe as an intermediary method to stimulate the interest of EN youth in home entertainment and promote the smart understanding of the home scene for a specific group of people. By conducting a questionnaire survey on users' internal and external emotions and behavioral needs, we analyze the future picture of smart home entertainment scene experience design and the portrait of EN youth under the empowerment of metaverse technology, and get the three major task indicators of immersive entertainment, sustainable intelligent human-home relationship, and open source ecological human-field interaction around three main home entertainment scenes, namely film, social, and game. This paper proposes an experience design strategy for EN youth living in China under "metaverse empowerment" in smart home entertainment scenarios, and explains how to provide EN youth in the metaverse era with an immersive entertainment experience, a sustainable smart habitat relationship and an open source ecological human-field interaction experience. The immersive experience provides a reference and reference for promoting the smart home scene experience towards a more human-computer inclusive interaction scenario.

CCS CONCEPTS

•Human-centered computing~Interaction design~Systems and tools for interaction design

KEYWORDS

Experience Design, Empty-Nest Youth, Smart Home, Entertainment Scene, Metaverse

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1 INTRODUCTION

EN youth are young people aged 20 to 35 who live alone in big cities, separated from their relatives and friends for work and other reasons. The massive formation of "empty-nest youth" in China today is a product of the combined effects of frequent social mobility, changing concepts of marriage and childbirth, and non-traditional lifestyles, and the tremendous changes in their digital existence, lifestyle and home habits[1].

There are various interactive forms of smart home entertainment experience. Jisun Jang[6] proposed to use Microsoft HoloLens to conduct HoloSensor research and use holograms for real-time home entertainment interaction; Gram-Hanssen [4]explored the security issues in smart home experience; Zheng Wan[12] proposed a personalized A smart home entertainment

system with recommendation and voice emotion recognition for entertainment experience through multi-sensory control. EN youths are a group of independent living and monotonous daily life. Yameng Wang[13] conducted a comparative study on EN youths of different genders and regions to extract the characteristics of their living habits. For the smart home industry, the different lifestyle preferences of young users are both an opportunity and a challenge. The meta-universe, represented by artificial intelligence and virtual reality technology, has built a new innovative practice field for the experience design of smart home scenes. The metaverse will deeply reshape the virtual-reality structure, content production, interactive interface and entertainment scene of smart home users, bringing them an immersive, three-dimensional, holographic and multi-dimensional space-time experience[15].

Although research on the application of metaverse technology in home and entertainment has been explored to some extent, no research has focused on the design of smart home entertainment scenarios for EN youth in the metaverse perspective, and there is still a lack of research from the perspective of two main subjects: new interaction forms and target users. This study explores the future picture of smart home entertainment scenes under the empowerment of metaverse, explores the emotional experience of EN youth in home entertainment scenes and their amplified influence on the living environment through the data collected from questionnaires and online interviews, and proposes some positive intervention design suggestions for the mismatch between the living environment and the needs of EN youth, and proposes a smart home entertainment scenes experience design strategy for EN youth in the metaverse. entertainment scene experience design strategy in the metaverse environment, and then provide a reference for the research on the user behavior and experience design of EN youth in the new interactive environment of smart home entertainment scene metaverse.

2 RELATED WORK

2.1 The current situation of empty-nest youth at home

In the process of promoting urbanization, young people are suffering from nostalgia and pressure from work and socialization, so the psychological state and emotional expression of this group should be given enough attention. Lee B, Kwon O,et al[7] concluded that in order to alleviate the loneliness caused by mood changes due to loneliness, smart entertainment services should be supported. Secondly, it is important to understand the problems of single-person households by grasping their needs for smart technologies. By identifying these difficulties, preparing smart scenarios helps to provide recommendations for smart services, and for this purpose, various scenarios and application methods should be developed. Future research will include attempts to combine smart services with the development of more diverse scenarios.

2.2 Smart home experience design in the stay-at-home economy

The trend of smart home purchasers in China is young, so understanding the smart home experience of young users is a major research point for future trending. In the background of domestic epidemic era isolation policy, the whole society has increased the time of Internet access significantly, and the "home" economy is developing rapidly. The social value of meta-universe comes from scenario-based socialization, which pursues experience, real-time interaction and diversified play, and brings a revolution about the future home, which will present the trend of intelligence, entertainment, multi-function and new links[1] .

Today's smart home takes the initiative to learn deeply and provide intelligent scene services, helping empty-nest youth to solve their life problems to different degrees, gradually covering the smart home scene to the ecosystem needed for living alone, so that young people's life experience is enhanced like never before. The smart home brands on the market are systematic and

incompatible, which has a negative impact on the realization of smart home pursued by more users. In order to achieve smart performance, it is impossible to just add screen or network functions to the product itself. Full consideration of user experience in the design and attention to the functional needs, emotional needs and interactive experience needs of users make the product a truly meaningful and beneficial smart product for users' lives[16]. At the same time, an in-depth understanding of user needs reduces the deviation of the final design effect from the inner needs of the occupants and largely reduces the uncertainty that exists in the design project. The innovative application of intelligent scenario-based, while promoting the future development of smart home, largely solves the practical problems faced by users' life nowadays.

Table 1: Smart home features at different phases of development

	Smart Home 1.0 Phase (Traditional Smart Home)	Smart Home 2.0 Phase (Smart Home in the Internet Era)	Smart Home 3.0 Phase (Smart Home in the Age of Metaverse)
Features	User-oriented intelligent products	User-centric Internet of Everything	Immersive user experience and content production for value co-creation between users and products
Media	Media for hardware products such as TVs	Smart media such as cell phones, home gateways, electric curtains, floor sweepers, etc.	The medium of online and offline integration
Technology	Materials, Engineering	Internet technology, multi-touch, gesture recognition interaction technology, gravity sensing	Artificial intelligence, digital twin, virtual-real interaction, Internet of things, blockchain, cloud computing technology
Sensory Interaction	Visual-based	Sight, sound, touch	Multimodal and multichannel interaction of sight, sound, touch, smell, taste, etc.
Advantages	Higher frequency of hardware product interaction	Strong interactivity and participation with the content of smart home devices to make up for the user's entertainment time and space deficiency	Scene can create unlimited, characteristic spatial environment transformation in limited space, empowering imagination, promoting the creation of users' digital world, and everyone is a content producer
Disadvantages	Limited interactivity and participation with entertainment content	The digital interaction method deliberately imitates traditional products and fails to design the interaction for the target users and the characteristics of the new technology	Because technology can bring about a meta-universe revolution, it leads to a tendency to fall into a technology-centric, rather than a content-centric, experience

2.3 Home entertainment scene experience design

The British scholar David Morley[8] argues that media studies should develop a "de-mediated" model of media research to better understand the relationship between "media furniture" such as television and the family by observing changes in the family scene over time. The relationship between media furniture such as television and the family. Domestic scholars Li Huijuan and Yu Guoming[5] investigated people's use of media in time and space and showed that the length and frequency of media use in the bedroom and the living room are very different, while pointing out that Internet TV will become an important device for leisure and entertainment in private homes. Meanwhile, the book "Age of Context: Mobile, Sensors, Data and the Future of Privacy" [10] argues that the focus of future products is to create a scene home.

This paper locates the user group in the empty-nest youth living in China, due to their greater demand for smart home, mainly focusing on entertainment and socialization. Because the smart home approach has become part of the modern urban lifestyle, a systematic analysis of the lifestyle of the empty-nest youth population and understanding of their home needs will help the design positioning and entry point of smart home products and design a smart home entertainment scene experience that meets their needs.

3 ANALYSIS OF USER'S HOME ENTERTAINMENT SCENE EXPERIENCE

3.1 EN Youth User Profile Construction

In order to ensure the accuracy of the subsequent research, this paper further defines the "empty-nest youth" user profile: EN youth users refer to Chinese young people between the ages of 20 and 35 who live alone in housing; at the same time, living alone also includes sharing a room with others or having a long-distance relationship.

In January 2022, 10 smart home empty-nest youth users living in first-tier cities in China were invited to conduct semi-structured video interviews, which yielded an analysis of the friend circle structure and social entertainment of the empty-nest youth population, as shown in Figure 1, while the following three user characteristics can be initially found: (1) Lack of core social circle: young office workers are prone to lack of friends due to graduation, job change, etc.; (2) Independent activities The time period is concentrated in the evening and weekend: social entertainment is mainly from 9 to 11 o'clock to release the pressure during the day, and the best time to relax after going home; at the same time, the social frequency is low on weekdays and high on weekends; (3) Easy to be lonely: work pressure, drifting and other reasons will make them feel lonely more easily.

The following two main types of user portrait models can be derived through interviews and combined with the screening of literature related to EN youth, as shown in Figure 2.

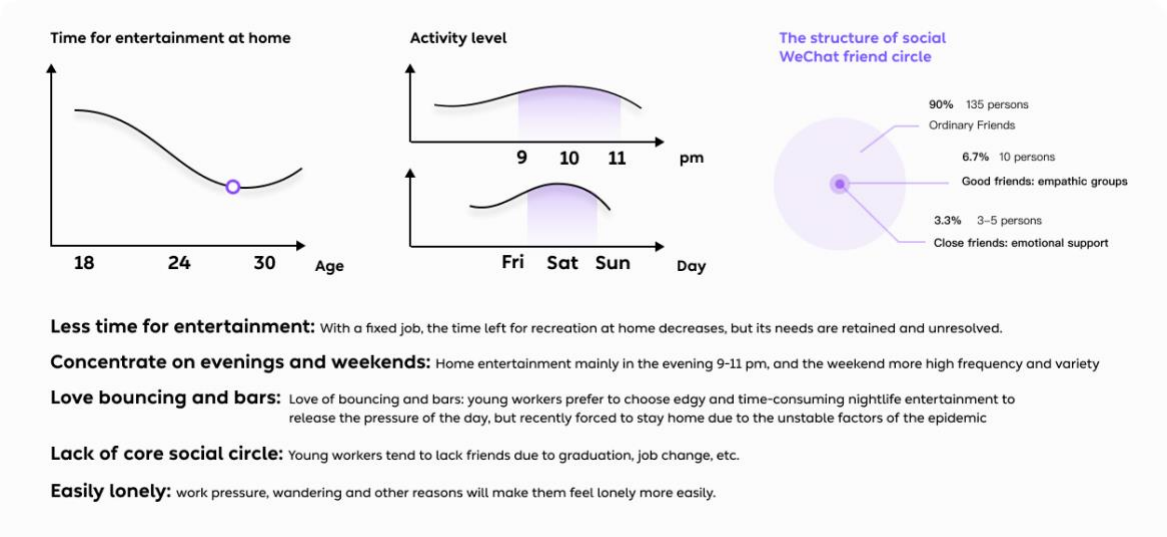

Figure 1: The current situation of recreational life for empty-nest youth (Figure originated from the author)

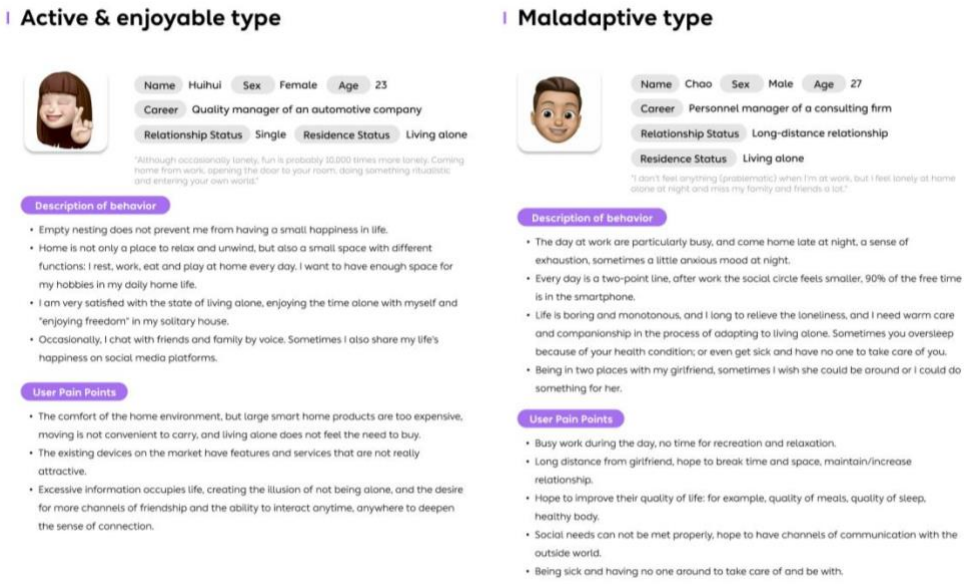

Figure 2: Empty-nest youth user profile (Figure originated from the author)

3.2 Questionnaire design and variable construction

Combining user interviews and user profile characteristics, a questionnaire design study was conducted to determine the theme of the questionnaire research design, which was to investigate the experience factors in the home entertainment scene of empty-nest youth. The variables of the questions in Table 2 were

split into three categories: independent variables, dependent variables and control variables.

The variable dimensions were designed and classified into variable types, and the questionnaire questions were refined according to the measures. The questionnaire study population was further screened and analyzed through video interviews. The results showed that the frequency of using smart home among the EN youths was much higher than that of the non-EN youth, showing that the EN youth rely more on smart home life.

Table 2: Variable partition and definition

Variable Dimension	Variable Name	Variable Type
Independent variable: daily behavioral habits	x1: The feeling of dependency that comes with a pleasant digital life	Continuous Variables
	x2: Frequency of using smart home devices	Continuous Variables
Independent variable: home device usage preference	x3: The importance of the scale layout of the home space environment	Continuous Variables
	x4: The importance of the functional use of home space	Continuous Variables
	x5: The light situation of home rest	Continuous Variables
Independent variable: home behavior preferences	x6: Home Fragrance Environment Favourites	Continuous Variables
	x7: Background music playing frequency at home	Continuous Variables
Dependent variable: satisfaction with different forms of entertainment	Y1: Home movie entertainment satisfaction	Continuous Variables
	Y2: Home social entertainment satisfaction	Continuous Variables
	Y3: Home games entertainment satisfaction	Continuous Variables
Control variable: Personal information	Year of birth	Continuous Variables
	Gender	Categorical variables
	Location	Categorical variables
	Current Living Style	Categorical variables

3.3 Questionnaire data analysis

In this study, questionnaires were distributed to the target population, Chinese empty-nesters, and 167 valid questionnaires were returned. Among the gender of the survey sample, there were 70 male respondents, accounting for 41.9% of the total sample, and 97 female respondents, accounting for 58.1% of the total sample. Among the survey sample, the number of respondents in economically developed regions of China was 133, accounting for 79.6% of the total sample; meanwhile, the post-90s and post-95s were 76.9% of the total sample.

3.3.1Multiple Linear Regression Analysis.

The linear regression equation of the relationship between the independent and dependent variables can be obtained through multiple linear regression analysis. The significance values are specified in Table 3 below.

(1) Regression analysis of independent variables and home movie entertainment satisfaction: the independent variables are seven question items of three measures of daily behavior habits, home equipment use preference and home behavior preference, and the dependent variable is home movie entertainment satisfaction. The linear regression equation was:

$$Y_1 = 2.009 + 0.201x_4 + 0.204x_6 + 0.165x_7 \quad (1)$$

According to the significance sig value, it can be confirmed that "the importance of functional usage of home space", "frequency of playing background music at home" and "popularity of home fragrance environment" have a significant positive impact on home audio-visual entertainment satisfaction, and "popularity of home fragrance environment" has a greater impact on home audio-visual entertainment satisfaction.

(2) Regression analysis of the independent variables and satisfaction with home social entertainment: the independent variables were seven question items of three measures of daily behavior habits, preference for home equipment use, and preference for home behavior, and the dependent variable was

satisfaction with home social entertainment. The linear regression equation was:

$$Y_2 = 1.919 + 0185x_4 + 0272x_5 + 0.257x_7 \quad (2)$$

According to the significance sig value, it can be confirmed that "the importance of functional use of home space", "the light condition of home rest", "the frequency of playing background music at home" have a significant positive effect on the satisfaction of home social.

(3) Regression analysis of the independent variables and home game and entertainment satisfaction: the independent variables are the seven question items of the three measures of daily behavior habits, home equipment use preference, and home behavior preference, and the dependent variable is home game and entertainment satisfaction. The linear regression equation was:

$$Y_3 = 1.600 + 0417x_1 + 0194x_2 - 0.240x_5 + 0.162x_6 \quad (3)$$

According to the significance sig value, it can be confirmed that "dependence on pleasant digital life", "frequency of using smart home devices", "enjoyment of home fragrance environment" have a significant positive effect on satisfaction with home games and entertainment. (3) Based on the significant sig values, it can be confirmed that "dependence on pleasant digital life", "frequency of using smart home devices" and "love of home fragrance environment" have significant positive effects on satisfaction with home games and entertainment; "light condition of home rest" has significant negative effects on satisfaction with home games and entertainment.

Table 3: Different entertainment scene satisfaction Prominence table

Dependent variable / Independent variable	Different entertainment scene satisfaction					
	Movie Entertainment		Social Entertainment		Game Entertainment	
	Factor	Significant	Factor	Significant	Factor	Significant
Constants	2.009	0.000**	1.919	0.018*	1.600	0.016*
1. The feeling of dependency that comes with a pleasant digital life	-0.027	0.642	-0.04	0.518	0.417	0.000**
2. Frequency of using smart home devices	0.109	0.235	0.039	0.687	0.194	0.019*
3. The importance of the scale layout of the home space environment	0.075	0.361	-0.049	0.570	0.028	0.829
4. The importance of the functional use of home space	0.201	0.002**	0.185	0.007**	-0.05	0.665
5. The light situation of home rest	0.024	0.700	0.272	0.000**	-0.240	0.004**
6. Home Fragrance Environment Favourites	0.204	0.036*	0.069	0.270	0.162	0.003*
7. Home background music playing frequency	0.165	0.018*	0.257	0.001**	-0.027	0.756

Note: **, * represent 1%, 5% significance levels, respectively

3.3.2 Quantitative Research Findings

Regarding home entertainment, according to the data of the sample characteristics, watching movies, social entertainment and electronic games are the main entertainment activities of EN youth, accounting for 81%, 75% and 63% respectively. Obviously, cell phones, computers, iPads and other electronic products have almost become the necessities of daily life, work and entertainment for EN youth, which fill a large part of their discretionary time and transfer some of their demands for real emotions and physical environment to virtual scenes, reducing the actual requirements for home life and scenes. To a certain extent, this explains why EN youth are not only dissatisfied with their home life and scenes, but also long for entertainment and outdoor environments, while maintaining stable emotions and behaviors. However, this situation requires a high degree of vigilance because it not only affects the true emotional health of EN youth, but also contributes to their sedentary habits, which in turn increases obesity and other risks. Therefore, it is not only

necessary to intervene in the behavior of EN youth and to channel their psychological entertainment needs, but also to improve and enhance the home entertainment scene in response to their needs.

3.4 Qualitative research analysis

The first stage of this chapter firstly entered the observation method research. This home entertainment experience invited 7 observation users, mainly choosing EN youth living in first-tier cities in the 22-35-year-old stage. At this stage, users have relatively independent analysis and analysis. ability to judge. Through behavior analysis, all expectations of users in the experience of home entertainment scenes can be obtained, and users' needs for human-machine products and scenes can be more accurately and comprehensively obtained. From the proportion of each demand problem in the summary of the observation results, we can intuitively understand the common opportunity points that urgently need to be solved in the home entertainment scene. For example, the entertainment experience and emotional needs of the current home entertainment scene have attracted the attention of most people.

In the second stage, interviews were carried out. The basic current situation data found that the proportion of empty nesters who were satisfied with their home life, activity space layout and entertainment methods accounted for 57.2%, 28.6% and 71.4% respectively, while the satisfaction with home equipment was 57.2%, 28.6% and 71.4% respectively. Not ideal, accounting for only 14.3%, which reflects the limitations of "hardware products" and "hardware home" in the living environment of empty nest youths. In comparison, only 28.6% of EN youth are satisfied with the scenery outside the window. Through the return visit, it is found that this result is mainly due to the spatial form of the large city where the respondents are located and the natural environment far away from the cement city. , so that many empty-nest youths living in high-rise residences can also have less than good vision and less than ideal outdoor landscape. The sound insulation effect is a problem option second only to the entertainment method, and its satisfaction rate is 42.9%, which has a greater relationship with the quality of the current youth housing. Compared with the sound insulation effect, the attitudes of empty nesters towards indoor light, indoor music and fragrance environment are relatively ideal, accounting for 57.2%, 71.5% and 57.2% respectively.

This interview study also set up related items for four aspects: projection screen equipment, audio equipment, virtual equipment and game equipment. According to statistics, 85.7% of EN youths like watching movies or K-songs, but 57.2% of the households do not have projection screen equipment or audio equipment; 71.5% of EN youths like virtual social interaction and game entertainment, but 85.7% of households do not have virtual equipment; 71.5% of EN youth like sports games and entertainment, but no more than 30% have somatosensory game equipment. It is not difficult to find that there is a big gap between the limitations of the home scene of empty nesters and their need to approach the ideal home entertainment scene and feel the scenery outside the window.

From the individual opinions of 7 empty-nest youths (Figure 3) on the current home scene collected through online return visits, it is not difficult to see that the current empty-nest young users’ needs for home entertainment scenes are consistent in different time and space, including sense of security, A sense of belonging, multifunctional spaces, recreational spaces, and healthy environments, and found the emphasis on WiFi in this target group.

Figure 3: Individual views of EN youth interviewed (Figure originated from the author)

4 EXPLORING THE USER EXPERIENCE DESIGN OF IMMERSIVE SMART HOME ENTERTAINMENT SCENES EMPOWERED BY METAVERSE

Empty-nest young users are mainly divided into three pendants in the process of interacting with smart home entertainment scenes, like film, social, and games. Combined with the conclusion of the questionnaire in the previous chapter, three major design strategies are proposed in three different entertainment scenes, mainly to improve the experience and value of empty-nest young users by improving the contact richness and interactivity of smart home scenes. (1) Immersive entertainment commonsense: The future virtual-real symbiosis technology under the Film network will cater to the multi-sensory demand characteristics of empty-nest youth, and stimulate empty-nest youth's commonsense of Film entertainment mode through multiple digital and spatial contacts to trigger emotions and enhance young users' emotional energy in entertainment. (2) Sustainable intelligent habitat scenes: Through the construction of multi-dimensional interaction scenes with full perception, it creates a home social meta-universe for empty-nest youth, restores the natural experience of digital co-habitation in social entertainment scenes, and adopts a combination of physical interaction and virtual interaction to trigger the next emotional interaction behavior through the generated emotional imagination. Based on the tactile experience, the interaction is guided in the tactile experience and the tactile experience is felt in the interaction. (3) Human-field interaction of open source ecology: users can generate game content participatively through content atomization and atomic formation library, bringing stronger flexibility and operable space, creating personalized adaptive operation game entertainment experience, reshaping user role positioning, and creating distributed experience design (Figure 4).

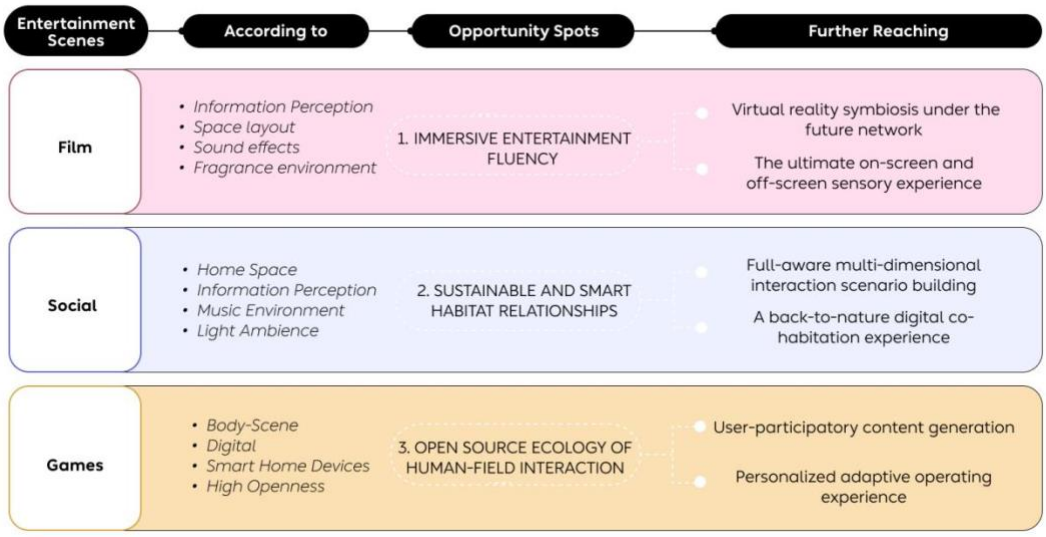

Figure 4: experience design strategy system (Figure originated from the author)

4.1 Immersive entertainment fluency: catering to the multi-sensory demand characteristics of empty-nest youth

4.1.1The future of film network: from the unity of sound and picture to the symbiosis of reality and imagination.

film is one of the channels for EN youth to perceive smart home entertainment scene experience, and it is necessary to extend from film experience to other sensory factors of the body, and extend from the body to the perception research of the scene. People have five senses, besides film, there are touch, smell and taste, and multi-sensory has the effect of communication between them. Taking the film sense of empty-nest youth as the basic senses and reasonably increasing the experience design of other senses can improve the comprehensive experience of empty-nest youth in the entertainment scene[3]. Flexibly using the virtual perception technology in the scene, through multi-dimensional perception technology, the product can obtain relevant information under the three dimensions of people, behaviors and scenes. Take the film entertainment scene as an example, perceive the smart home, space layout, music, climate and other information, through a series of visual, spatial sound effects and other content of the viewing entertainment scene to the user to convey the viewing information, strengthen the environment to assist and promote the emotional viewing experience, for example, in the former cinema to watch a realistic sense of 5D movies and the current market popular VR experience hall can amplify the real sense of the audience's surroundings: the audience can be in the "lightning, lightning, space, space, and so on. In the future, with the maturity of meta-universe technology, the symbiotic world of reality and fiction will enable more people to experience the most immersive movie-viewing experience without leaving home in a smart home.

Traditional film and television entertainment is an art form that relies on the two narrative elements of picture and sound. VR, AR and other emerging technologies and then the film entertainment scenes empowered by the metaverse integrate image, action, structure, sound, environment and other film components, making the content of the film

entertainment scenes present a rich and diverse situation. With Shanghai immersive drama "Sleep No More" and script killing as the representative of the viewing mode is sought after by the young public, from a single viewing mode to participatory film entertainment scene is the inevitable direction of film entertainment, the film entertainment scene of the meta-universe era will redefine the sensory characteristics of the film entertainment scene from multiple aspects of the future network, creating a more immersive virtual-real entertainment experience for empty-nest youth users. In addition to simple gesture tracking and motion capture, VR devices, a type of mobile terminal digital product, can also achieve haptic feedback, electromyographic simulation, directional tracking, voice feedback, gravity feedback and other experiences, improving the user's sense of participation and bringing a unique aesthetic enjoyment. However, smell and taste are the sensory elements that are not yet directly touched by traditional film, VR and other digital products. The film entertainment scenes empowered by the metaverse not only bring the enjoyment of sound and picture unity and content symbiosis, but also enable readers to create digital identities to enter the story theater of film and television, providing a multimodal, multi-channel, virtual and real immersive film entertainment scene experience.

4.1.2 Create the ultimate on-screen and off-screen experience: multi-dimensional user interface experience design.

empty-nest youth respondents repeatedly said that when playing and entertaining at home, physical relaxation and scene interaction sensing, smart home equipment digitalization, fragrance environment relationship is particularly important. The new home film network needs to be interconnected with "a screen terminal as the core of the smart home system" for multiple digital contacts, and to digitally operate a single and isolated individual hardware product or smart product. At the same time, with the exploration of intelligent interaction in recent years, as well as the technological evolution and algorithm iteration of artificial intelligence, the interaction experience of smart home entertainment scenes in the meta-universe era will definitely become more natural and intuitive, easy to learn and use, integrating physical, gesture, action, eye movement, voice and other channel interaction technologies for natural scene interaction experience, exploring "empty-nest youth Social entertainment friendly" and more target user types of experience design principles, will be one of the development directions of the future-oriented smart home entertainment scene in the meta-universe era.

Figure 5: Virtual image design for multi-site devices (Figure originated from the author)

4.2 Smart Sustainable Habitat Scene: Creating a Social Meta-Universe for empty-nest Youth at Home

4.2.1 Full-aware interaction scene building: more flexible spatial interaction layout to adapt to changing scenarios.

With the deep integration of future metaverse technology and the digital life of smart home entertainment scenes for EN youth in the new era, users will have a unique metaverse virtual image in their future homes, and through the virtual image, they can simulate their identity in the social metaverse entertainment scenes, so how to design easy-to-use and efficient demand-oriented social entertainment scenes interaction interface for EN youth has become an important issue now. The biggest difference between the metaverse era and the Internet era is the establishment of a three-dimensional entertainment space, which allows

smart home users to acquire, communicate and produce content through a multi-dimensional user interface in a complete virtual space. The new Web 3.0[14] interaction paradigm should be established. The immersion of EN youth when experiencing smart home social entertainment scenarios is built on excellent interaction design, as well as elements such as music environment and light atmosphere in the intelligent environment to build a virtual-real symbiotic social entertainment experience.

4.2.2A back-to-nature digital co-habitation experience.

Users can create a unique digital home alone or together, and are no longer limited to the various interaction boxes set by a single smart product in the past. The experience of naturalistic interaction makes the digital identity of the user's friends and family more relevant. When wearing XR devices, the immersive real-time sensing of social activities in the third scene where friends and family live together with you at the moment. Through digital means to improve the current shortcomings of the physical home, for example, eager to contact the nature of the empty-nest young users, the reality of the home does not have a balcony, you can create a forest villa home experience through digital. The game and entertainment can generate a third space according to the user's vision and social relationship in different, to solve their loneliness, social pressure and anxiety, and to meet the experience and expectation of co-housing with friends and relatives in different places for the empty-nest young users. Every space and place inside should be naturalized and interactive, and the systems are interconnected and interoperable. Users can empower their friends and relatives to remotely operate some of the smart devices in the home in such an open and inclusive interactive space, realizing natural interaction in the true sense.

4.3 Open source ecology of multi-dimensional human-field interaction: shaping a multi-channel, immersive gaming experience

4.3.1Participatory entertainment experience: from a single fixed content to user-participatory generated content.

With the arrival and progression of the metaverse era, the coding world shows how technology can penetrate into the physical environment in a silent way. When technologies such as 5G, augmented reality, ambient computing, and smart materials are integrated with the physical environment, the smart home industry will open up a new way of interacting with the real world, while smart home users will interact with smart devices in an unprecedented way to automate and personalize their settings and creative play. In traditional game entertainment, the game development team is the unchanging creator role and holds the absolute storytelling right. In the meta-universe era, the identity boundary between players and developers of game entertainment works will become blurred, and its subject is transforming. Starting from the Web 2.0 era[9], the inherent creation mode of game entertainment is being impacted, and at the same time, under the impact of the home economy, a door of creation is opened for every smart home user, guiding that in the new world of digital-real integration, users are still the protagonists. EN youth are no longer just recipients and players of game content in the meta-universe-enabled smart home entertainment scene, but also creators and developers of film content, which has positive significance for enhancing the entertainment immersion of EN youth and their digital creation literacy. Users generate content on the open source ecology through participatory generation, making the content itself atomized. By combining atomized instructions with the formation of atomized instructions and the expectation that they can use the same library of atomized instructions with shortcut scenes, the threshold for creating games is greatly reduced.

4.3.2Personalized adaptive operating experience.

With the increase of smart devices in the homes of EN youth, each device has its own experience strengths and limitations, for example, editing text on a TV screen is a very bad experience compared to a cell phone. By splitting and reorganizing the various atomized capabilities of multiple devices through distributed experience design, we can make them work together and complement each other's strengths to create a more ultimate home experience. While the game platforming, in the process of popularizing the game participatory content generation, the playing method will also need to adapt to the mass and low threshold, which requires the open source platform to give the user a certain range of operating space.

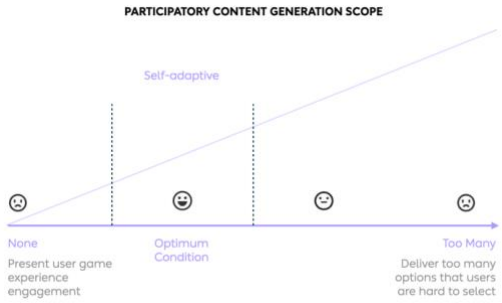

Figure 5: Participatory Content Generation Scope (Figure originated from the author)

In Giles Colborne's "Simple and Usable Web,Mobile,and Interaction Design" [2], it is argued that the concept of feedback should be emphasized in interaction design, and that interaction is a communicative interaction between subject and object, and the information exchange during interaction is bidirectional. And there is often a time delay between behavior and feedback, so adaptive operation should include fault tolerance, process, and synchronization. When users operate specific areas of the game and entertainment scene, the game should have real-time adaptation function to bring a more process entertainment interaction experience. The intelligent home game entertainment scene should be compared with the model in the database in the process of receiving user information to get relatively accurate behavioral results, and the form of feedback should be more concise to reduce the cost of user social cognition. Through atomization disassembly and new carrier adaptation, the game entertainment can be wisely generated according to different young users in the smart home scenario, adaptive operation experience. In the experience design, it is reasonable to require the technical support of low latency and personalized self-adaptation of the device, such as by establishing the adaptation of virtual image head, bust and full body image with multi-end device applications (Figure 6), and setting up timely and accurate clear adaptation and response mechanism to improve the user experience in multiple entertainment scenes.

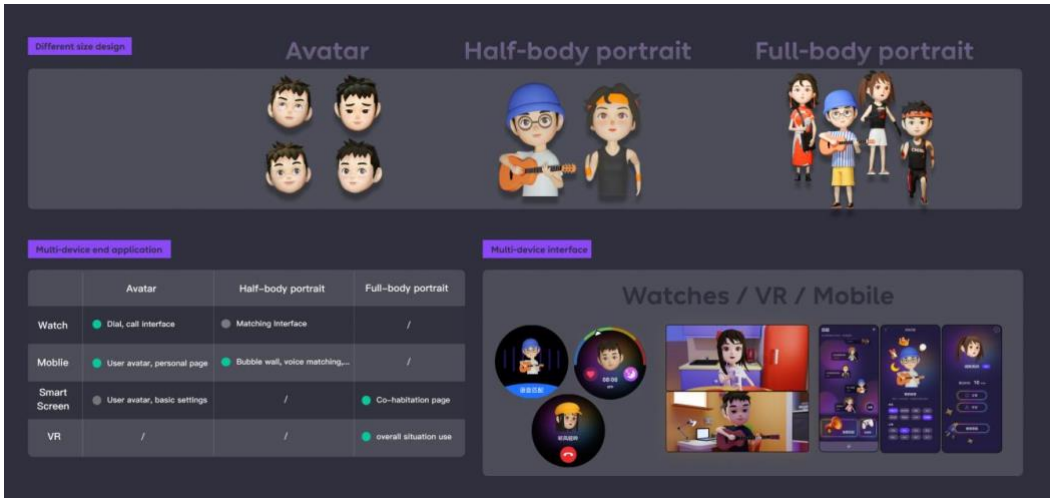

Figure 6: Virtual image for multi-device application adaptation design (Figure originated from the author)

5 DISCUSSION

This section will discuss the individual and societal benefits, limitations, and challenges of using the system.

Research in this area is promising. Living alone is becoming a trend in youth housing, and due to the epidemic, there is a growing demand for a more sophisticated living experience and an increasing need for entertainment scenarios in the home.This study takes the emerging and increasing group of "empty-nest youth" as the research object of smart home scenario experience, based on group culture research, integrated psychology and design analysis and evaluation methods and tools, to construct the object group model of user's entertainment scenario experience in home scenario, and then to explore the potential user needs from both explicit and implicit aspects. The study also proposes a set of corresponding experience design strategies and new paradigms, and the experience design research for EN youth plays a pioneering role in satisfying users' own needs.

This study aims to address the current bottleneck of entertainment needs in smart home entertainment scenarios. The type of information presented by the metaverse is very rich, but the information feedback methods are mainly visual, voice and the less mature haptic feedback methods. Although these feedback techniques have their advantages to a certain extent, they still have fatal experiential flaws. Immersive entertainment commonsense, sustainable intelligent human-habitat relationship building, and more friendly and natural open-source human-field interaction are advantages that make the smart home entertainment scene a better experience.

The future film network under the virtual reality symbiosis technology is the basis to start the next overall entertainment scene experience new possibilities, these means are not enough to complete the emotional presentation of film information, and combined to its way with the ultimate experience inside and outside the screen as the purpose of the supplement; about the social entertainment scene, full perceptual multi-dimensional interaction is an upgrade of the former, it emphasizes the tactile experience can be combined with other information presentation and to The user participatory content generation makes the distributed experience design a trend, as well as the personalized adaptive operation interval also gives to the combination of the previous large framework, the advantages of this approach can form a complementary and better apply to carry out the experience design of the game entertainment scene.

The participants in this study were from first-tier Chinese cities (Beijing, Shanghai and Shenzhen) with high consumption levels, and in the future, we could test a sample of "EN youth" participants of the same age group in different cities, with more diverse occupations and habits. For this study, the use of multisensory feedback can also be better applied to people with disabilities, such as the blind and deaf, to better help them experience entertainment scenarios in their homes. The perceptual information that fits the target population can be used to make up for their lack of other sensory channels, which is a shortcoming in this work, and future research can focus on people with disabilities. In addition, this study makes the home entertainment scene for empty-nest youth as a case study population, which helps to make reference for other people.

6 CONCLUSION

This study explores the future picture of smart home entertainment scenes empowered by the metaverse, deeply explores the home entertainment needs of EN youth in China, and divides the entertainment scenes and user types into more detailed categories, which further leads to the human-computer interaction elements of the social metaverse of home entertainment for EN youth. The quantitative relationship between the elements of three smart home entertainment scenes: film entertainment, social entertainment and game entertainment is studied, and the corresponding results are translated into smart home entertainment scenes experience design strategies to provide young empty-nester users with smart home entertainment scenes experience design that better meets their needs, and to promote the digital content experience of young people's homes in the metaverse era to a more human-computer integration interaction picture.

Through this study, the home problems and needs related to EN youth have received attention and discussion from companies and researchers. The iterative design results of this study will participate in the Huawei Hongmeng whole-house smart home enterprise cooperation project, which further promotes the development of the field of smart home for empty-nest youth living alone.

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