

The Trend of Research on Design for Healthy Ageing: A Visual Analysis Using VOSviewer and CiteSpace

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Abstract: Background: Based on the research needs of Design for healthy ageing, policy support visualizes and analyzes the output distribution, research hotspots, and cutting-edge trends of Design for healthy ageing related literature. Research Aim: In order to better carry out research in the field of design for healthy ageing segmentation, we use core data-bases to explore the progress of design for healthy ageing area research at home and abroad from a macro perspective. Methods: The method uses the Web of Science core collection database and China National Knowledge Infrastructure (CNKI) database as data sources to export the output distribution, research hotspots, and cutting-edge trend visualization graphs of literature. Results: The results were compared and reviewed with the help of visual literature analysis software VOSviewer and Citespace on relevant literature both domestically and internationally. Conclusions: The time course of research progress on ageing design and the development prospects of ageing design research discipline were summarized. Summarize the research progress and cutting-edge trends in the field, perspective, and content of ageing design discipline. The conclusion is influenced by policies and the environment, and there are certain similarities and differences in domestic and foreign research. In the context of the sudden global epidemic, the exploration of social participation in design for the elderly is a common research hotspot. The difference lies in that foreign research focuses on Service design for the elderly, focusing on the health ageing framework of WHO, targeting families, basic nursing services, virtual health and design for healthy ageing service technologies.

Keywords: Designing for Healthy Ageing; Research Progress; Visualization; Analysis.

1. Introduction

1.1. Research Background

China has a tradition of respecting the elderly since ancient times, and contemporary research on the adaptation of the elderly emphasizes interdisciplinary development. Since the 1980s, there has been research on the needs and mental health of the elderly [1]. The National Commission on Ageing established a national multidisciplinary comprehensive research institution on Ageing issues (China Ageing Science Research Center) in 1989[2]. However, scholars such as Bai Xuefeng et al. [3] pointed out that the concept of "age friendly design" in the field of design was not mentioned until the 2003 study on housing Ageing. [4]. Fortunately, due to its interdisciplinary nature, the concept of "adapting to the elderly" has been widely recognized in the field of design since then. In terms of the urgency of designing for the elderly, China is currently one of the countries with the largest elderly population (with an Ageing rate of 12.0%) [5]. According to the seventh national population census data in 2020 (July 2021), the total population of people aged 60 and above accounts for 18.7%, with 190 million people aged 65 and above accounting for 13.5% [6]. The design for healthy Ageing, also known as design for healthy Ageing in foreign countries, generally revolves around the relevant conceptual framework and goals of the World Health Organization (WHO) [7]. The WHO defines "Healthy Ageing (HA)" as the process of developing and maintaining functional abilities that promote elderly well-being (1987). Since 2000, this term (HA) has been widely mentioned within a certain scope [8].

The research on the scientific achievements related to ageing and design can review the process of knowledge construction and the prospects for theoretical development in

this field. Therefore, it is necessary to conduct more research on the use of bibliometric indicators in related fields.

1.2. Research Purpose

The research purposes are to sort out relevant literature on design for healthy ageing in China and those developed countries, taking Web of Science and CNKI databases as typical data sources. And secondly it is targeted at using visual graph research methods to analyze the research status. Thirdly, the next research is to understand the distribution of research forces at home and abroad, and the current research hotspots, explores the research frontiers and directions, and provides effective references for subsequent research. This is because In recent years, the field of design for healthy ageing has developed rapidly both domestically and internationally, with a large number of research literature emerging. However, there are relatively few latest review studies.

1.3. Research Objective

In this paper, in order to better carry out research in the field of design for healthy ageing segmentation, we use core databases to explore the progress of design for healthy ageing area research at home and abroad from a macro perspective.

To be more specific, the research objective based on the research aim above to use information visualization tools VOSviewer and Citespace to summarize the research progress, hotspots, and trends in this field by (1) output distribution (national cooperation, research institutions), (2) research hotspot distribution (literature co-citation), (3) keyword co-occurrence, and (4) keyword clustering.

1.4. Research Methods

The research method is to use visual analysis methods to visually analyze representative literature on age friendly

design research. Specifically, VOSviewer is a software tool used to construct and visualize bibliometric networks. [9] Like CitNetExplorer, VOSviewer has advanced interaction algorithms and publication clustering techniques. Citespace is another bibliometric drawing software tool used for analyzing, detecting, and visualizing trends and patterns in scientific

literature. [10] The two have different bibliometric key techniques and evaluation criteria, so they can complement each other.

2. Literature Review

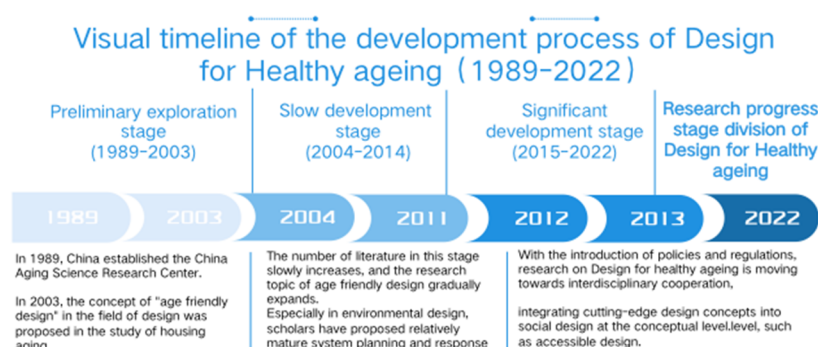


Figure 1. Visual timeline of the development process of Design for Healthy ageing

To review the development process of research on design for healthy ageing, the discussion on the development process of research on design for healthy ageing is based on the literature review conclusions and visual analysis of multiple scholars [11, 12]. The conclusion is that in terms of the development process of age friendly design, based on the literature review of scholars on the development process of research on design for healthy ageing in China and the induction and summary of different periods, the research trend of age friendly design is integrated and analyzed, as shown in Figure 1. Overall, research on design for healthy ageing in China can be divided into three stages: preliminary exploration stage (1999-2003), slow development stage (2004-2014), and significant development stage (2015-2022). Specifically, before 2003, it was the embryonic stage, during which research mainly focused on basic theoretical research and published multiple papers and works introducing Chinese gerontology and the elderly; From 2003 to 2014, we were in the stage of focused exploration in the field of elderly friendly design. Specific design for healthy ageing case introductions, process method summaries, and comparison of experiences from other countries began to emerge in China; After 2014, research began to diversify, introducing new technologies such as big data and information design methods, and a large amount of design practice research emerged, especially in the field of furniture and product design. The research hotspots are mainly reflected in various aspects such as new methods of elderly friendly design, elderly friendly interaction and service design, and design for healthy ageing social design. This means that research on age friendly design is gradually receiving attention from the government, reflected in policy support and the introduction of policy regulations. The overall research trend is progressing, reflected in the increase in the number of published articles in the literature volume, and the research field is becoming more extensive and interdisciplinary. So as to apply cutting-edge new methods and new thinking in inter-disciplinary fields.

Many scholars have conducted visual analysis of the research progress on age friendly design from different perspectives. Representative literature includes, firstly, the CiteSpace visualization analysis of research progress on smart homes for the elderly by Mu and Wu (2022) suggests that the study of smart homes for the elderly should be more quantitative, universal, practical, and establish manufacturing

systems and standards [12]. However, the search terms are limited, and the key words for designing smart homes for the elderly are only for the elderly. Lack of relevant terminology such as design for healthy ageing. Similarly, Liu's "Analysis of Research on Elderly Furniture Design Based on CiteSpace at Home and Abroad" (2023) also has a single search term and only focuses on the keyword "elderly". The conclusion compares the development process of elderly design in China and the West, but it is relatively vague and fails to summarize the key nodes and reasons for differences. Valuably, He et al. (2022) 's "Comparative Analysis and Prospects of Ageing Research and Furniture Ageing Design Based on CiteSpace" explored literature visualization in the sub field of ageing design and furniture design, selected rich and detailed search terms, and summarized future trends in four aspects: research field, research population and research strategy, and design policy. Unlike Mu et al. who believe that the design of elderly products should be universal, He et al. pointed out that research fields should be subdivided to form a multi-level elderly design system [13]. The progress and innovation of this article lie in the first step of selecting more suitable search terms, the second step of attempting to define the policy reasons for key time changes based on previous achievements, and the third step of providing suggestions for the development of age friendly design from the perspective of design discipline.

3. Methodology Framework

The structure of this article is as follows: The first part includes the research framework and bibliometric research; The second part introduces the analysis results in WoS and VOSviewer; The third part introduces the discussion of the cutting-edge trends in research on ageing design; Finally, the fourth part introduces the conclusions of this study.

3.1. Overview of Research Data Acquisition

To ensure the credibility and cutting-edge research value of the data sources, an analysis was conducted from both English and Chinese literature. Data collection deadline is 00:00 UK on December 15, 2022. Retrieved from the Web of Science database and China National Knowledge Infrastructure. Firstly, indexes include SCI, SCI Expanded (SCIE), A&HCI, and CPCI-S. This study uses the term TS= ("Design for healthy ageing" or "HA"), allocated between 2018 and 2022,

and document type: articles, comments. Index: A corpus covering the conduct of this study was selected, resulting in 905 valid English sample literature. Secondly, the Chinese language was selected from the CNKI database of China National Knowledge Infrastructure (CNKI) using (Theme: Design for healthy Ageing) OR (Theme: Elderly Design) as the search term. The allocation time was from 2007 to 2022, and 595 valid sample articles were obtained, which was Covered the corpus for conducting this study.

3.2. Data Analysis of Research Progress on Design for Healthy Ageing

3.2.1. Distribution of research output on design for healthy ageing

In the study of design for healthy ageing, a collaborative visualization network between different regions is formed based on the coupling of articles, authors, in-institutions, and countries, as shown in Figure 2. In terms of cooperative output, the main ones are European and American countries such as the UK, Italy, and the United States. The ranking of publication volume by country and region is listed in Table 1, with 68 countries/regions participating worldwide, and 41 countries/regions having published more than 5 articles in this

field.

As far as the time series change of the output distribution of the design for ageing research is concerned, the Line chart of the time series change of the domestic and foreign design for ageing research document quantity drawn by He et al, is shown in Figure 3[13]. In 1999, domestic scholars first published research literature related to this topic (He et al, 2022) [13]. It can be seen that design for healthy ageing is not an emerging field of design, but has long received attention. According to further research, the underlying reason for this is the continuous increase in the proportion of the elderly population and the increasingly severe ageing problem. According to the global population forecast of the United Nations, the proportion of the elderly population has undergone significant changes[14]. Specifically, from 2011 to 2050, the proportion of people aged 60 and above in most countries showed a rapid upward trend, as shown in Figure 4. According to World Bank statistics, Japan is the country with the most severe population ageing (28%); Next are most countries in Europe, as well as Canada (approximately 20% of the elderly population). 11% of the population in China is elderly. Globally, elderly people aged 65 and above account for 9.1% of the global population.



Figure 2. Cooperation distribution map among countries and regions

Table 1. Top five countries/regions of papers of Design for Healthy Ageing

Serial Number	Country/Region	Number of publications	Total citation of literature	Total correlation strength
1	Britain	208	6412	328
2	Australia	149	3211	81
3	Italy	106	3259	207
4	America	97	4789	159
5	the Netherlands	93	5649	193

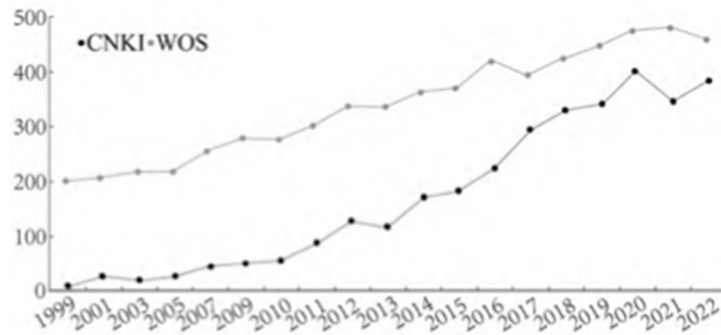


Figure 3. Amount of papers as time changes all over the world [13].

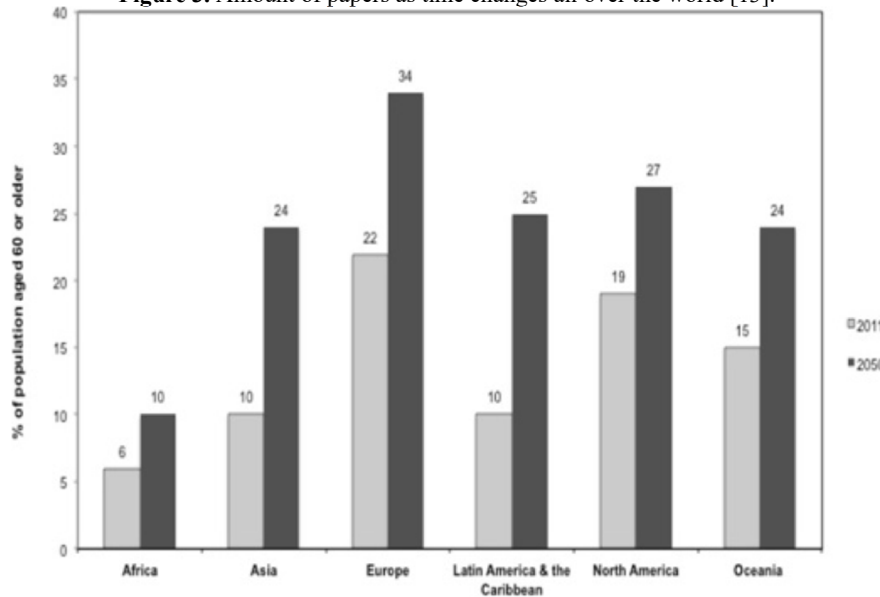


Figure 4. A Histogram of the change in the proportion of the ageing population [14].

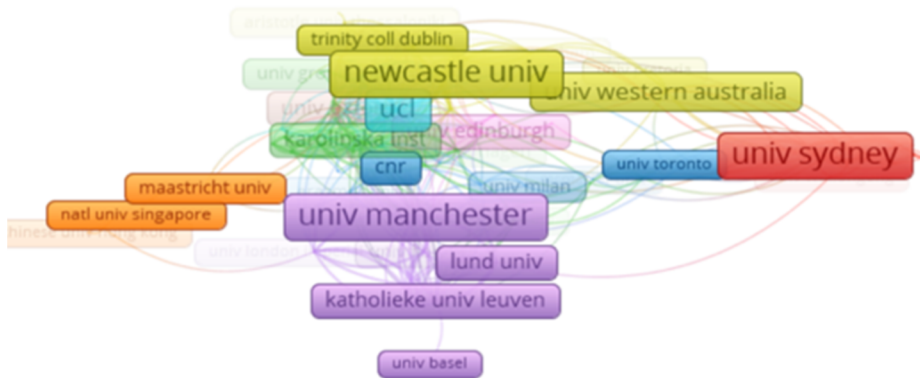


Figure 5. Cooperation distribution map among foreign institutions

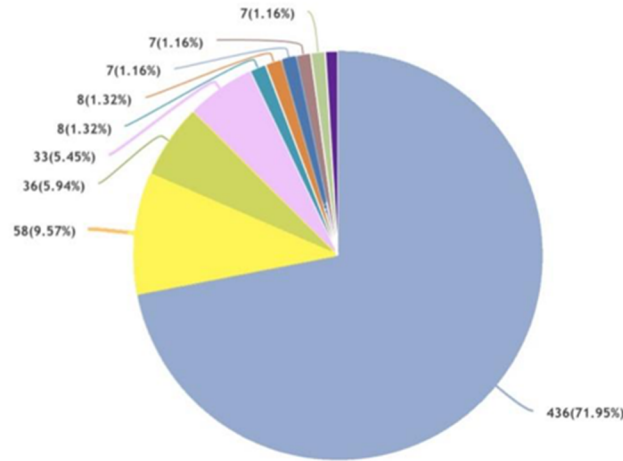
According to the coupling, the graph of the cooperation network of foreign institutions is shown in Figure 5. From 2018 to 2022, a total of 98 institutions from different countries/regions participated in research in this field. The ranking of foreign institutions' publication volume (top 5) is shown in Table 4. Institutional coupling is the scientific research coupling between world famous universities represented by the University of Manchester in the UK. To be specific, although Australia is the country where the largest number of papers are published, see Table 2, the citation rate

of British literature is far ahead: University of Manchester (1117), University College London UCL (1061), Cambridge University (21, with a total citation of 1263).

In terms of the current distribution of research disciplines, see Figure 6. The distribution of research disciplines in China is relatively broad and not limited to theoretical research in design, but more from multiple disciplines (VOSviewer shows 48 disciplines). However, the boundaries between disciplines are not very clear (subject domain segmentation and subject concept division) [13].

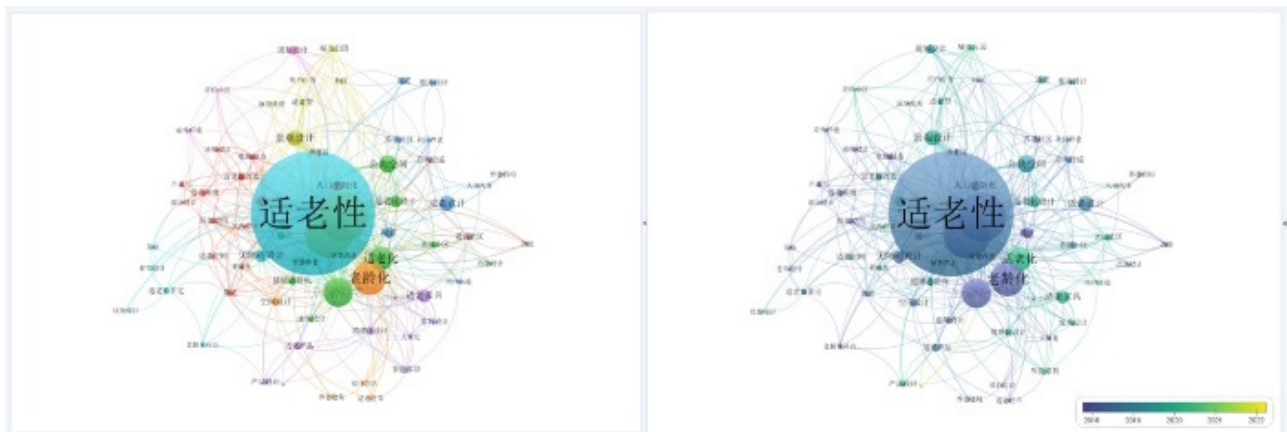
Table 2. Top five of foreign institutions of published design for healthy ageing papers in number

Serial Number	institution	Number of publications	Total citation of literature	Total correlation strength
1	University of Sydney	28	675	21
2	University of Newcastle (Australia)	27	807	36
3	University of Manchester	26	1117	51
4	University of Melbourne	26	393	35
5	University College London	23	1061	46

**Figure 6.** Distribution of Research Disciplines of Design for Healthy Ageing in China

This is in line with the research findings of scholars such as He Ming on design for healthy ageing, whose Citespace visualization conclusion covers more than 40 disciplines. Specifically, the proportion of research on design for healthy ageing in the field of architectural science and engineering is the largest, at nearly 72%, followed by design for healthy ageing in the light industry and handicrafts, at about 10%. The second is industrial design (industrial General-purpose technology and equipment), Chinese politics and international politics, and design for the age of computer software and computer applications, accounting for 5.94%, 5.45% and 1.32% respectively. Through further research, it has been found that in response to the issue of unclear disciplinary boundaries, the construction of design disciplines suitable for the elderly in foreign countries is worth learning from. The construction of the "Healthy Ageing" design discipline abroad has certain reference value. In the

continuous development and development of various professions, gerontology and geriatric medicine are regarded as a relatively independent research category, with clear disciplinary concepts and segmented modules. For example, the United States has a comprehensive elderly care industry, and there is an industry chain between segmented markets as a link to adapt to the diverse needs of the elderly [14]. The government of Japan's elderly care industry takes the lead in elderly care and healthcare as the entry point, and penetrates six major fields such as the service industry and residential industry. Its mature elderly care design industry has formed an industry, and actively expands the Chinese elderly care design market, such as leaders in the elderly care design industry such as the Japanese Medical Museum and Beilesheng; Canada, on the other hand, focuses on research on elderly care for elderly patients with chronic diseases and has made progress [15].

**Figure 7.** The diagram of keywords in design for healthy ageing research abroad

Using the keyword co-occurrence analysis function of VOSviewer, generate a keyword co-occurrence graph for domestic research literature on elderly friendly design, as shown in Figure 7, and a high-frequency keyword co-

occurrence frequency in Table 3. Clustering the keyword co-occurrence network can reveal four main clusters. Macroscopically speaking, in terms of timeline, 2018-2019 focuses on Ageing and elderly care architecture, community

design, 2029-2020 age friendly landscapes, age friendly urban parks, and age friendly furniture. Starting from 2020,

we will pay attention to elderly friendly and accessible design, as well as elderly friendly public facilities.

Table 3. Keywords

Serial Number	keyword	Co-occurrence frequency	total connection strength	Serial Number	keyword	Co-occurrence frequency	total connection strength
1	Ageability	173	187	17	Barrier Free Design	11	17
2	Ageing design	68	59	18	Space design	11	15
3	old people	65	87	19	healthy ageing	11	8
4	Ageing	48	68	20	Old communities	10	20
5	home care	41	61	21	Old residential area	10	13
6	Adaptive ageing	33	40	22	Elderly adaptation transformation	10	12
7	Public Space	25	41	23	Emotional Design	10	11
8	Landscaping	22	42	24	Ageing products	10	10
9	Age friendly design	21	9	25	Ageing	10	8
10	Accessible design	19	25	26	public facilities	9	18
11	Elderly furniture	19	18	27	City Park	9	17
12	Ageing resistant design	18	11	28	living space	9	16
13	Design Strategy	16	20	29	Retirement	9	15
14	Design	15	18	30	Retirement Community	9	13
15	population ageing	15	16	31	furniture design	9	13
16	plan and design	13	21	32	Product Design	9	11

Cluster 1: Ageing suitability clustering, consisting of clustering keywords such as Ageing suitability, Ageing society, accessible design, smart elderly care, humanistic care, elderly care institutions, elderly care communities (community elderly care), etc. Further research has found that the current Code for Accessibility Design, drafted by the China Center for Ageing Science and other organizations, takes into account the age suitability of accessibility design in an Ageing society [16], which to some extent guides the forefront of research in this field.

Cluster 2: Clustering of elderly friendly design in public spaces, consisting of keywords such as Ageing friendly design, old residential areas, renovation design, home care, residential design, healthy Ageing, etc. Further research on clusters 1 and 2 reveals that, firstly, these clusters of public spaces and community keywords are related to China's elderly care policies. Meanwhile, secondly, the development process of the elderly care industry in the United States also has similar clusters, which are worth learning from. The design and development of elderly care communities have gone through three stages: embryonic, developmental, and mature. From the emergence of charitable communities, to standardized and professional elderly care communities promoted by the Housing Law, and finally to the formation of a socialized elderly care industry that is highly integrated with capital, providing diverse and diverse solutions to meet the needs of elderly care, Ultimately becoming one of the pillar industries of the US national economy[17].

Cluster 3: Ageing Architecture Design Cluster, consisting of keywords such as Ageing, elderly care buildings, elderly friendly housing, design methods, spatial design, etc.

Cluster 4: Interior Design Ageing Design Cluster, consisting of keywords such as interior design, residential

space, Ageing space, evidence-based design, universal design, outdoor environment, etc. Further research on clusters 3 and 4 revealed that Evidence Based Design (EBD) is a cutting-edge architectural environmental design method that combines Evidence Based Medicine (EBM) and environmental psychology. Can construct quantitative research models from various aspects such as building energy consumption, environmental characteristics, elderly care processes, and patient experience [18,19]. As a cutting-edge trend in design methods, it has also been studied and applied by Chinese scholars in the field of age friendly architectural design, and has become a new trend.

In summary, further exploring the co-occurrence of keywords and visualizing graphs shows that research is more focused on the Ageing design of environmental design (community public space Ageing, indoor Ageing, furniture Ageing, landscape and outdoor environment Ageing, etc.), especially the Ageing furniture design. The underlying reasons behind this are the "9073" elderly care model proposed in China's "National Eleventh Five Year Plan" (2006-2010) (Shanghai region). In February 2011, the Ministry of Civil Affairs issued the "Twelfth Five Year Plan" for the construction of the social elderly care service system (2011-2015), officially proposing the "9073" elderly care project. [17, 20] Specifically, in the "9073" plan for the future pattern of elderly care in China, Wang Haidong (Director of the Elderly Health Department of the National Health Commission) pointed out that the majority of elderly people in China should take care of themselves at home and in the community. That is, about 90% of elderly people are taking care of themselves at home, about 7% rely on community support for elderly care, and 3% live in institutions for elderly care. In the 13th Five Year Plan period (2016-2020), the State

Council issued the "National Development Plan for Ageing and Construction of the Elderly Care System" (2017), which combines home and community, and is referred to as "consolidating the foundation of home and community elderly care services". The "14th Five Year Plan" (2021-2025) and the "14th Five Year Plan for the Development of National Ageing Undertaking and Elderly Care Service System" (2022) also propose the establishment of a basic institutional framework for actively responding to the national strategy of population Ageing, and accelerate the improvement of a coordinated elderly care service system that combines home community institutions and medical care and health care [21]. Specifically implementing the "six assistance services" in home-based communities to meet diverse elderly care needs [20, 22]. Therefore, the design of "medical and elderly care integration" services and environmental design (home and community) in the field of elderly care design is a cutting-edge trend that has become inevitable to a certain extent [5, 19].

4. Summary and Prospect of Research Progress on Design for Healthy Ageing

4.1. Summary of Research Progress on Design for Healthy Ageing

The summary of research progress summarizes the analysis of the exported graph in this article, which involves the research progress of age appropriate design and two aspects of research shortcomings.

Firstly, an analysis was conducted on the research progress of age friendly design, and the results showed that: firstly, the development trend of age friendly design in China has been rapid in the past five years, with an increasing number of publications; Secondly, the research countries are mainly the United Kingdom, Italy, and Australia, with the United Kingdom occupying a leading position in research; Third, research institutions are dominated by universities. Several universities in the UK, led by the University of Manchester, have more research on age appropriate design. Universities in various countries cooperate frequently with other universities in their own countries, but less with other international institutions; Fourthly, packAgeing engineering is the most influential research publication, and urban residential houses have the most articles included. Fourthly, the collaboration between authors often takes the form of teams, with topics centered around the clustering of elderly care needs in the context of the 13th Five Year Plan in China.

Secondly, there are still some shortcomings in the current research on elderly friendly design in China, mainly manifested in the following suggestions for improvement:

(1) Strengthen cooperation with international elderly friendly research institutions. There is relatively little cooperation between research institutions in other countries, possibly to some extent due to the different age appropriate design policy frameworks followed and varying research focuses. For example, UK universities focus on age appropriate products and interaction design under the WHO Health Ageing Framework, targeting more specific and inclusive elderly groups, while Canadian universities focus on digital interactive age appropriate design, focusing on the diversity of age appropriate users through digitization;

(2) Optimize the theoretical construction of elderly friendly design discipline. The theoretical definition of age friendly design is not yet clear, and it is often confused with theories such as inclusive design and Ageing design. The theoretical relationship between them needs further clarification.

4.2. Outlook on Research Progress in Age Friendly Design

The prospect of research progress on age friendly design is based on the previous text and the achievements of scholars, and is discussed from three aspects: the field of age friendly design discipline, disciplinary perspective, and disciplinary content. The digital transformation in the context of the intelligent era has magnified the differences in individual human abilities, and the deepening of Ageing has also exacerbated the overall degree of ability damage. Improving the Ageing suitability of products and services is one of the most effective solutions to these problems. In response to this, scholars such as He Ming have provided forward-looking guidance on the future development trend of elderly friendly design from the perspectives of "diversification in the design field, refinement of the design population, systematization of design strategies, and policy support for design". Based on this perspective, future research in the field of elderly friendly design should be based on the theoretical system of design studies, with a balance in four aspects: segmented fields, elderly friendly populations, elderly friendly strategies, and elderly friendly policies. Under the framework of the 13th Five Year Plan (2016-2020), the "13th Five Year Plan for Healthy Ageing", the "13th Five Year Plan for National Ageing Development and Elderly Care System Construction" (2017), the "General Technical Requirements for Elderly Care Furniture" (Beijing, 2021), as well as the revision of the "Law of the People's Republic of China on the Protection of the Rights and Interests of the Elderly" and other new national and local elderly care policies, as well as the guidance of new regulatory decisions in the elderly care industry [19, 20], Systematically promote from three aspects: the field of elderly friendly design, disciplinary perspective, and disciplinary content.

Specifically, firstly, in the field of age friendly design, foreign countries have shifted from a single discipline to an interdisciplinary approach. Research on traditional Ageing design in foreign countries focuses on medicine and sociology, addressing the issue of product or service Ageing from the perspective of basic healthcare. In recent years, with the guidance of the World Health Organization on healthy Ageing, research has gradually begun to focus on inclusive design at the interdisciplinary level of Ageing experience, reflected in design cognition, design interaction, design culture, and other aspects. Specifically, in the field of elderly friendly social design, we can draw inspiration from social innovation design thinking guidance [23, 24], achieve multi-party co creation with the participation of the elderly [8, 25], and fully consider the user experience of the elderly in the field of elderly friendly product design [26]. Especially for the segmented market of elderly friendly design products, we fully integrate the era background, such as the application of interactive cutting-edge service design thinking models to the design of elderly friendly intelligent travel services [27], Enhance the travel experience for the elderly. At the same time, in addition to the field of environmental design in design studies, domestic design for the elderly should also integrate a single design discipline into multiple disciplines such as cognitive

psychology, management, and computer science. In the future, design for the elderly is destined to be an interdisciplinary and diversified discipline.

Secondly, in terms of the perspective of age friendly design, there is a shift from universal age friendly research to targeting specific "diversity". Based on the World Health Organization's "Healthy Ageing Framework" (HAF), research on the diversity segmentation of elderly people is focused on. [8] In terms of the key thinking shift towards stereotypes of elderly people, elderly people also have diversity. The WHO points out that there is no similar "typical elderly people" The concept of "age" is based on the fact that age is an indicator that is almost unrelated to psychology and spirit. Currently, in China, elderly care design focuses more on elderly people who can take care of themselves. However, with the acceleration of social change and the abundance of material conditions, people's individual abilities also tend to be diversified, resulting in the amplification of differences between individuals. This requires elderly care design to have a more diverse and inclusive perspective, based on social and psychological inclusiveness [28] Taking into account the diversity of specific groups based on their needs, such as the needs and treatment of elderly people with disabilities, the design of elderly care for those with difficulty walking, the nursing needs of elderly Alzheimer's patients, and the study of emotional therapy for elderly people with cognitive impairments [29]. Secondly, the perspective of the design discipline for the elderly fully pays attention to the differences in demand for age segmentation (such as the differences in demand between 65+and 60+elderly people) [30]and the gender differences in age adaptation [13].

Thirdly, in terms of the content of the elderly friendly design discipline, there is a shift from physical material design to virtual interaction design. On the one hand, the trend of ageing requires designers to still pay attention to the Ageing suitability of products and services. In the future, the elderly population will be a huge consumer group, and research on Ageing friendly design of products and services will inevitably become one of the design trends; On the other hand, the arrival of the new era of intelligence has brought new challenges and provided new ideas for design for healthy ageing. The "digital divide" in virtual interaction design and digital design requires solutions that are suitable for the elderly. The development of modern big data and artificial intelligence has also made it possible to design unique and targeted solutions for the diverse needs of elderly customers, so as to meet the needs of elderly design in China to the greatest extent possible based on policy support.

5. Conclusion

In summary, with the arrival of new eras, environments, and technologies suitable for the elderly, systematic literature reviews can explore research gaps, future research trends, and new opportunities for Design for healthy ageing. In response to the research gaps and opportunities in the design of healthy ageing, visual analysis tools such as VOSviewer were used to visually summarize and analyze the WOS core database (over the past five years) and literature on Design for healthy ageing from China National Knowledge Infrastructure (CNKI) over the past decade. On the basis of reviewing previous visual literature, this paper summarizes the emerging research hotspots and cutting-edge research trends in elderly friendly design, as well as the history and disciplinary aspects of the research progress in elderly friendly design. We look forward

to the analysis results of Design for healthy ageing, which will provide demonstration and guidance for research on Design for healthy ageing in China.

Meanwhile, this study also has certain limitations. This study only selected literature data and CNKI data from typical representative WOS core databases, and the analysis results may have some deviation from reality, hoping that future researchers can conduct analysis and research in a more accurate and comprehensive manner.

Acknowledgments

Thanks to my mentors, Dr. Wang Shan and Dr. Li Zhenjian. Dr. Shan was a knowledgeable and beautiful lady who has provided suggestions for design for healthy ageing in Winchester. Dr. Zhenjian was also my mentor who taught us how to design, how to become a good scholar as well as always encourage and support me.

References

- [1] X.Wang, Q.S.Ma, H.X.Dou:Statistical analysis of literature on mental health of the elderly in China. Chinese Journal of Gerontology, 2013(In Chinese).
- [2] China Ageing Science Research Center. Information on: <http://www.crca.cn/index.php>.
- [3] X.F.Bai, J. Zheng, C.L.Zhou, H.Wang:Analysis on the Research Process and Trend of China's Adaptability to Ageing Based on Citespace Knowledge Map. Chinese Journal of Gerontology, (2021),41 (20): 4561-4566.
- [4] Z.H.Bao: The "Elderly Adaptation" Transformation of American Housing. China's Housing Facilities, 2003; (4) :45-3.
- [5] S.Liang,M. Zhou, L.M. Zhou,J.G.Zhu:Francesca Tosi. China's existing elderly care service model and development based on literature research. PackAgeing Engineering, (2022),43 (22):p. 408-417.
- [6] Main Data of the Seventh National Population Census in 2020. Edited by the Leading Group Office of the Seventh National Population Census of the State Council. I -(Beijing: China Statistics Press, 2021.7) (In Chinese).
- [7] Alexandrakis D.,Chorianopoulos K. And Tselios N:Insights On Older Adults' Attitudes And Behavior Through The Participatory Design Of An Online storytelling platform. In IFIP Conference on Human-Computer Interaction. Springer, Cham (2019).(p. 465-474).
- [8] Comincioli, E, Chirico, A, Gaggioli, A. And Masoodian, M.: The Need for a Paradigm Shift in Approaching Ageing-Related Design Research and Practice. Frontiers in Psychology, 2021.12.
- [9] Van Eck, N.J., Waltman, L: Citation-based clustering of publications using CitNetExplorer and VOSviewer. Scientometrics 111.(2017). p.1053-1070.
- [10] X.Pan,E.Yan,M.Cui,W.Hua:Examining the usage, citation, and diffusion patterns of bibliometric mapping software: A comparative study of three tools. Journal of informetrics, (2018) 12(2), p.481-493.
- [11] Y.Mu,Z.H.Wu:CiteSpace Visual Analysis of Research Progress of Smart Home for Seniors in China and Overseas. Chinese Journal of Wood Science and Technology. (2022). p.90-91.
- [12] X.H.Liu:Comparative Analysis of Foreign and Domestic Ageing-friendly Furniture Design Based on CiteSpace. Furniture & Interior Design ,(2023),30(07):32-38. (In Chinese)

- [13] M.He,Z.M.Liu,Y.S.Zhou,J.T.Zhang:Comparative Analysis and Prospect of Ageing Research and Furniture Ageing Design Based on CiteSpace China Forest Products Industry. (2022), 59 (10),p.56-62.
- [14] United Nations:World Population Outlook two thousand and twenty-two. (2022).Information on [https:// population. un.org/ wpp/](https://population.un.org/wpp/).
- [15] X.Qin Xia, S.Y.Guo, W.Yang:CiteSpace based quantitative and visual analysis of English literature on the integration of medicine and nursing (integrated care for the elderly) . West China Medical Journal, (2021) Vol. (12),p. 49-56.
- [16] GB 50763-2012, Code for Accessibility Design.
- [17] Overview of the development of the elderly care industry in 2019 and analysis of the future elderly care model. Information on https://m.sohu.com/a/345717771_100055665?_f=m-article_ch.
- [18] Hamilton, D.K. and Watkins, D.H., 2008. Evidence-based design for multiple building types. John Wiley & Sons.
- [19] Y.D. Chen, Z.Cui, Hao Luo Xi. Exploration of evidence-based design method for age appropriate color environment based on VR technology -- Taking the interior color design of age appropriate buildings as an example. Journal of Lighting Engineering, (2019), 30 (02), p.123-129.
- [20] National Health Commission: China's elderly care is in a "9073" pattern. Information on [http://www. rmzxb. com.cn/ c/ 2021-04-16/2831140.shtml](http://www.rmzxb.com.cn/c/2021-04-16/2831140.shtml).
- [21] The Fourteenth Five Year Plan for the Development of the National Aged Undertaking and the Elderly Care Service System Chinese government website. Information on [https:// www. mca.gov. cn/article/xw/ mtbd/202202/ 2022 0200 039833. Shtml](https://www.mca.gov.cn/article/xw/mtbd/202202/20220200039833.Shtml).
- [22] How to "add weight" to the happy life of the elderly? New measures for the elderly care during the "Fourteenth Five Year Plan" came.Guangming.(2022).Information on [https://m.gmw. cn/baijia/2022-02/22/1302814890.html](https://m.gmw.cn/baijia/2022-02/22/1302814890.html).
- [23] Manzini E. Design:When Everyone Designs. (Cambridge,MA: MIT Press, 2015).
- [24] Y.H.Jiang, Y.K.Chen,R.K. He:Visual analysis of research progress in social innovative design PackAgeing engineering, (2021), p. 222-229.
- [25] Murray R, Caulier-Grice J, Mulgan G. The Open Book of Social Innovation: Ways to Design, Develop and Grow Social Innovations. (2020)London: The Young Foundation and NESTA.
- [26] F.Hu, Z.Y.Feng, D.C.Liu, W.Wang:Re study of user experience design: from concept to method. PackAgeing Engineering, 41 (16) (2020),p.51-63.
- [27] D.Y.Dong: Design and Research on Service Design Based Smart Travel APP Interface for the Elderly (Nanjing University of Posts and Telecommunications, 2022.).
- [28] J.Q.Xu: Multidimensional analysis and visualization of inclusive design methods Design (21), (2021),p.102-105.
- [29] Y.Y.Yin, L.Collier L: Impact of Chinese Traditional Art Training as an Emotional Therapy for Older People with Cognitive Impairment in the UK. In Service Design Practices for Healthcare Innovation Springer, Cham.(2022). (p. 399-424).
- [30] S. Wang: Investigation of People Aged 65+'s Home Living Room Experience for Improving Living Room Design in the UK (Doctoral dissertation, University of Southampton, 2020.).