Article

Not peer-reviewed version

User Interface Characteristics Influencing Medical Self-service Terminals Behavioural Intention and Acceptance by Chinese Elderly: An Empirical Examination Based on an Extended UTAUT Model

Qun Wu , Lan Huang * , Jiecong Zong

Posted Date: 15 August 2023

doi: 10.20944/preprints202308.1069.v1

Keywords: Medical Self-service Terminals (MST); Older adults; Unified Technology Acceptance and Use Theory (UTAUT); User interface characteristics

Article

User Interface Characteristics Influencing Medical Self-Service Terminals Behavioural Intention and Acceptance by Chinese Elderly: An Empirical Examination Based on an Extended UTAUT Model

Qun Wu [1,2], Lan Huang [1,*] and Jiecong Zong [1]

[1] Institute of Universal Design, Zhejiang Sci-Tech University, Hangzhou (PR China);
[2] Collaborative Innovation Center of Fashion Design and Manufacture of Zhejiang Province, Hangzhou (PR China);
* Correspondence: for5am@163.com

Abstract: Medical Self-service Terminals (MST) offer potential for process optimization and enhanced patient convenience in hospitals, including the elderly. However, the behavioral inclination (BI) of elderly Chinese individuals towards MST adoption remains suboptimal. This study aims to elucidate BI determinants for MST among the aging demographic, focusing on User Interface (UI) attributes within the extended Unified Technology Acceptance and Use Theory (UTAUT) Model. The empirical inquiry examines seven factors, comprising three key UI attributes and four fundamental UTAUT factors. Results reveal significant positive associations of Performance Expectancy (β=0.40, $p<0.001$), Effort Expectancy (β=0.50, $p<0.001$), and Social Influence (β=0.25, $p<0.05$) with BI. Notably, User Interface Design positively correlates with Performance Expectancy (β=0.89, $p<0.001$) and Effort Expectancy (β=0.81, $p<0.001$). These findings emphasize the interplay between objective UI attributes and subjective UTAUT determinants. This research enhances understanding of UI's impact on MST BI and acceptance, particularly within the Chinese elderly population, urging MST researchers to prioritize elderly attitudes for effective technological integration in healthcare.

Keywords: Medical Self-service Terminals (MST); older adults; Unified Technology Acceptance and Use Theory (UTAUT); user interface characteristics

1. Introduction

Hospital resources are becoming increasingly scarce and difficult to access, primarily due to the rapidly growing elderly population [1,2]. In order to alleviate this issue, Medical Self-service Terminals (MST) have been introduced in hospitals, aiming to streamline the processes for patients [3,4]. These terminals provide more convenient services, and the elderly are one of the audience groups. However, the propensity of elderly Chinese individuals to exhibit positive Behavioral Intention (BI) towards the adoption of MST remains below the desired threshold. This discrepancy can be attributed to various factors such as the unfamiliarity with novel information technology[5,6], confusing User Interface (UI) designs[7,8], and unclear operational processes[9,10]. To enhance the acceptance and use of MST among the Chinese elderly, it is imperative to identify the specific UI characteristics that influence their BI.

The Technology Acceptance Model (TAM) is a well-established theory in the field of information technology (IT) that has been successfully applied to investigate the acceptance and utilization of new IT in workplace settings [11–13]. Since its introduction by Davis [14] in 1989, TAM has been widely adopted in various disciplines to study technology acceptance [11]. A fundamental assumption of the TAM is that the BI of older adults towards accepting and using MST is contingent upon their subjective attitudes.

Among the various theories related to TAM, the Unified Theory of Acceptance and Use of Technology (UTAUT) [11] has gained widespread popularity. UTAUT identifies four main determinants that significantly impact the BI of older individuals towards MST,including

 doi:10.20944/preprints202308.1069.v1

Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC). Aguilar-Flores et al. [15] conducted a study using UTAUT to investigate the factors influencing the use of information technology among older adults. Their findings, demonstrated a 55% utilization rate of IT among the elderly based on the latent variables. Soh et al. [16]applied UTAUT to study elderly Malaysians' online shopping perceptions. The research outcomes revealed that primary factors promoting online shopping among the elderly included PE, SI, and FC.In a separate investigation, Yang et al. [17]employed the meta-UTAUT model to delve into the influence on intent and behavior of smartphone usage among senior citizens. The study recruited 311 participants aged 60 to 75, and it was observed that PE emerged as the most significant factor impacting BI.Additionally, Rój J. [18]employed the UTAUT model to scrutinize the acceptance and utilization of e-health among the 60-69 age group. The results underscored the strong significance of PE in influencing the elderly's acceptance and usage of electronic healthcare, followed by EE and SI. Expanding upon the UTAUT framework, Park et al. [19] explored factors affecting Korean attitudes towards mobile government services. They found trust in services influenced adoption via PE and EE. Although previous studies have explored the factors influencing older adults' subjective acceptance of healthcare Information Systems, these studies overlooked the objective impact of usability, which differs significantly between MST and other hardware or software.

How to evaluate the usability of UI is crucial for studying and enhancing the usability of Mobile Sensing Technology. Heuristic evaluation is a widely-used theoretical approach to optimize the UI usability of products designed for elderly individuals. Tsai et al. [20] employed Nielsen heuristics to explain the usability of UI design and utilized ISO 9241-11 to assess the usability and acceptability of an exergame system among 101 older adults， finding a strong correlation between interface design and system usability.. Kim et al. [21] found that "simple" and "intuitive" user interface language is the main factor influencing elderly people's preference for user interfaces and interaction methods. Amid the pandemic, Hamid Reza Saeidnia et al. evaluated smartphone app UIs for the elderly, emphasizing tailored design and user interface importance. Similarly, Zhou et al. [22] discovered that older users preferred a simple interface, and C-Life's white login screen enhanced the execution of periodic tasks. Despite the valuable insights these studies provide in understanding the determinants of usability in healthcare products, they did not adequately address the subjective impact experienced by older adults.

Recent studies have highlighted the correlation between the usability of UI and the BI of older adults. Sumak et al. [23] proposed that the quality of user interface (UIQ) directly influences users' perception of EE and PE. Their research findings also demonstrated that UIQ significantly impacts user acceptance of technology at all stages. Turetken et al. [24] indicated that PE and EE are significantly influenced by user familiarity with the navigation (NAV) of a system's UI. The NAV of a system's UI is associated with task-related information and the cognitive abilities of users. However, further investigation is required to understand how UI characteristics affect the BI of elderly individuals in the context of MST technology acceptance studies.

The UTAUT model has been expanded in this study by incorporating the Nielsen-Shneiderman Heuristic to investigate the impact of UI characteristics in MST on the BI of older adults in China. The proposed model consists of two components: UI characteristics, which are evaluated using the Nielsen-Shneiderman Heuristic [25], and technology acceptance, as defined by the UTAUT model. To validate the model, an empirical study was conducted, involving testing and evaluation of MST with a group of Chinese elderly participants. The results of the empirical study support the suitability of the proposed model in the context of MST research. The validated model provides valuable insights for researchers, designers, and policymakers seeking to enhance the acceptance and utilization of MST among older adults. By offering a holistic framework that bridges subjective perceptions and objective design aspects, this study contributes to the promotion of sustainable and user-centric technology solutions tailored to the needs of the aging population.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 15 August 2023 doi:10.20944/preprints202308.1069.v1

2. Materials and Methods

2.1. Research framework

The research framework, as depicted in Figure 1, consists of several components. UI characteristics are assessed through three factors: System Support (SS), User Interface Design (UID), and NAV. UID and NAV collectively influence the perceived PE and EE of the system. Additionally, SS, PE, EE, SI, and FC serve as predictive factors in determining the BI of Chinese older adults towards MST.

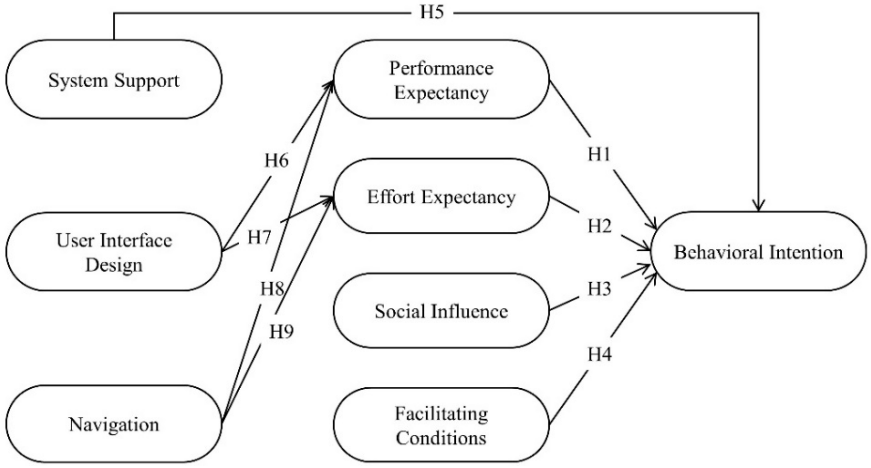

Figure 1. Research model for the relationship between UI characteristics and BI.

2.2. Hypotheses

2.2.1. UTAUT

To understand how UTAUT defined the subjective cognition of older adults, the hypotheses H1, H2, H3 and H4 were proposed.

H1. PE is significantly correlated with the BI of the elderly to MST.

H2. EE is significantly correlated with the BI of the elderly to MST.

H3. SI is significantly correlated with the BI of the elderly to MST.

H4. FC is significantly correlated with the BI of the elderly to MST.

2.2.2. Nielsen–Shneiderman Heuristic

To understand how UI characteristics affected BI of older adults using MST, Nielsen-Shneiderman Heuristic[25] was used as a measure of UI usability, and divided them into three categories (SS, UID, NAV)[26] according to previous researches (Table 1). Therefore, the hypotheses H5, H6, H7, H8 and H9 were proposed:

H5. SS is significantly correlated with the BI of the elderly to MST.

H6. UID is significantly correlated with the PE of the elderly to MST.

H7. UID is significantly correlated with the EE of the elderly to MST.

H8. NAV is significantly correlated with the PE of the elderly to MST.

H9. NAV is significantly correlated with the EE of the elderly to MST.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 15 August 2023 doi:10.20944/preprints202308.1069.v1

Table 1. Measurements.

Dimension	Variable	Sub-Heuristics	Item number
User Interface Characteristics	System Support	H7. Agility H8. Remind H9. Warning H11. Reversible H12. Language	5
	User Interface Design	H1. Conformity H2. Visualization H6. Respond H10. Ending H13. Control	5
	Navigation	H3. Matching H4. Compendious H5. Remember H14. Support	4
Behavioural Intention	Performance Expectancy	/	3
	Effort Expectancy	/	4
	Social Influence	/	3
	Facilitating Conditions	/	4
	Behavioural Intention	/	4

2.3. Data collection

In this study, the questionnaire used was adapted from English questionnaires commonly used in previous studies. We expanded and translated the questionnaire into Chinese to better align with the Chinese context. The questionnaire consisted of three parts: (1) demographic information, (2) a UTAUT questionnaire, and (3) a heuristic assessment scale. The demographic information section gathered five relevant demographic variables. Participants' satisfaction was assessed using the UTAUT questionnaire, which consisted of 11 questions, and the heuristic assessment scale, which included 54 questions. Each item in both questionnaires was evaluated using a five-point Likert-type scale, ranging from 1 (very dissatisfied) to 5 (very satisfied). To ensure the relevance of the survey instruments, modifications were made based on the results of a pre-experiment. Changes were made to align the wording with the research topic, such as replacing "system" with "MST". Additionally, irrelevant items (H8. Message and H14. Document) were eliminated from the questionnaires.

The study included participants who were urban older adults aged 50 years or older residing in mainland China. This age range was chosen based on the concept of the digital divide, which is commonly defined as starting at the age of 50 [27] (Table 2). For the experimental setup, a nineteen-inch touch-screen display was utilized to simulate the self-service registration process. The high-fidelity prototype of the MST (Figure 2) was selected from a Grade III Level A hospital in Hangzhou, China, which provided public service terminals in an open space. As indicated in Table 3, four specific tasks were chosen for UI usability testing. Following the usability testing, participants were asked to complete a series of questionnaires. To ensure consistency and eliminate potential cognitive differences among older adults, interviews were conducted after participants had independently completed the tasks on the MST. During these interviews, participants were questioned about their thoughts and experiences while using the MST.

Table 2. The Chinese Internet Penetration Rate of Population of All Ages in 2018.

Age	10-19	20-29	30-19	40-49	50-59	Over 60
%	19.6	30.0	23.5	13.2	5.2	5.2

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 15 August 2023 doi:10.20944/preprints202308.1069.v1

Table 3. Four Tasks of Participants.

	Tasks
1	To assume that you had a cold, and to complete a "registered today"
2	To assume that you had a stomachache, and to complete an "appointment registration"
3	To complete a Self-service payment
4	To complete an account recharge

The research hypotheses were assessed using a structural equation model. To test the model, Confirmatory Factor Analysis was conducted using Amos 24 software.

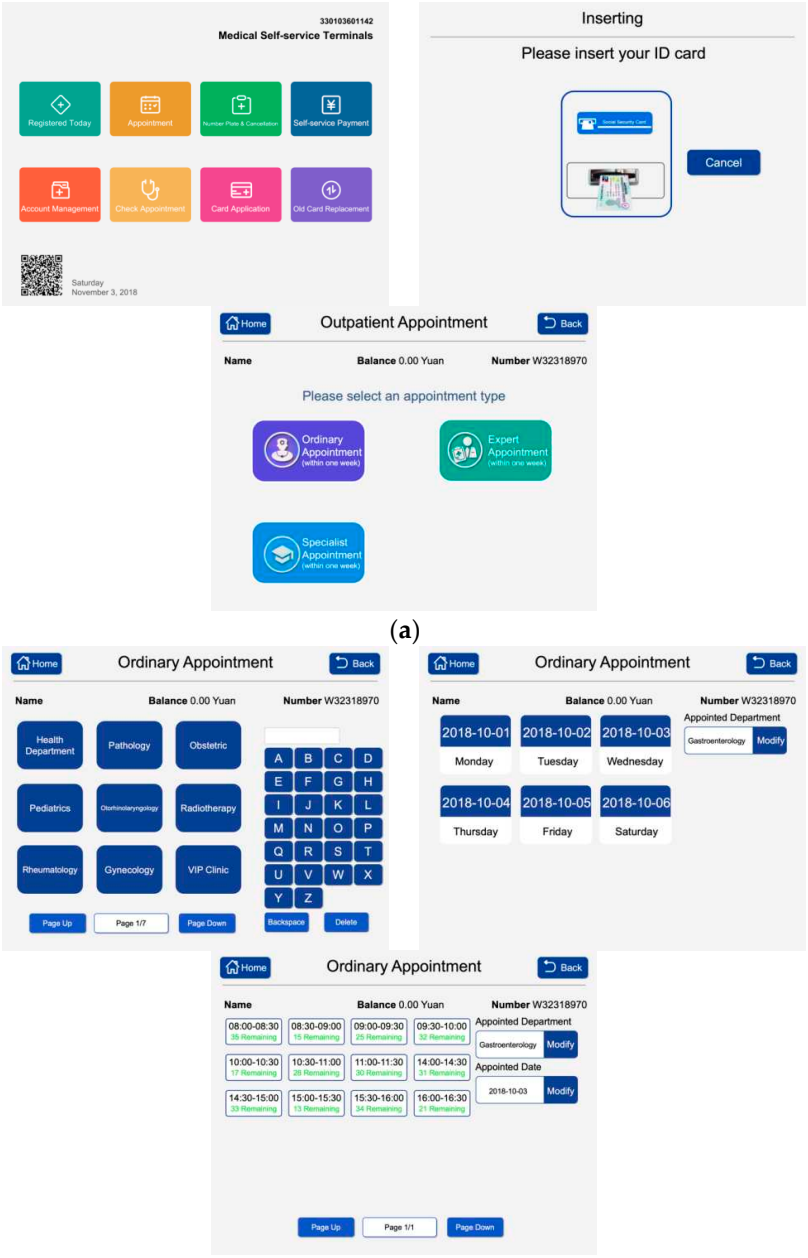

Figure 2. Registered page steps 1-6.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 15 August 2023 doi:10.20944/preprints202308.1069.v1

3. Results

3.1. Data collection

A total of 78 valid questionnaires were collected for this study. The participants were Chinese adults aged 50 years or older who were recruited from elderly communities in Hangzhou, China. The demographic characteristics, knowledge about the MST, and internet surfing frequency of the participants are presented in Table 4. Among the participants, 49 (62.8%) were female. The majority of the participants (59%) were in the age range of 55-70 years, with only 12.8% being older than 71 years. In terms of education, 70.6% had completed primary school, middle school, or high school. It is noteworthy that 65.4% of the participants had no prior experience with the MST, despite 65.1% reporting daily internet surfing habits. Furthermore, participants aged 50-54 (28.2%) and 65-70 (32.1%) constituted a significant proportion. Additionally, a considerable percentage of participants had completed middle school education (35.9%) or high school education (32.1%).

Table 3. Four Tasks of Participants.

Demographic category		Frequency	Percentage (%)
Gender	Male	29	37.2
	Female	49	62.8
Age	50-54	22	28.2
	55-60	10	12.8
	61-64	11	14.1
	65-70	25	32.1
	71 or older	10	12.8
Education	Primary school	2	2.6
	Middle school	28	35.9
	High school	25	32.1
	College (3 years degree)	14	17.9
	University (4 years degree)	8	10.3
	Graduate school	1	1.3
MST Experience	Experienced	27	34.6
	Inexperienced	51	65.4
Internet Use Frequency	Monthly or less	8	10.3
	Weekly	20	25.6
	Everyday	18	23.1
	Daily	32	41.0

3.2. Measurement model

The Composite Reliability (CR) values of PE, EE, SI, FC, BI, SS, UID, NAV ranged from 0.798 to 0.919, indicating good reliability in this study (Table 5)[28]. The Average Variance Extracted (AVE) values of PE, EE, SI, FC, BI, SS, UID, NAV ranged from 0.501 to 0.740, exceeding the standard value of 0.5 (Table 5)[29]. This suggests that the CR in this research is also good.

Table 5. Results of reliability and validity tests.

Variable	Cronbach's Alpha	Factor Loading	CR	AVE
PE	0.896	0.715-0.884	0.846	0.648
EE	0.839	0.630-0.790	0.824	0.540
SI	0.726	0.728-0.772	0.798	0.569
FC	0.838	0.728-0.815	0.843	0.574
BI	0.961	0.777-0.898	0.919	0.740
SS	0.726	0.667-0.737	0.801	0.501
UID	0.731	0.624-0.827	0.858	0.549

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 15 August 2023 doi:10.20944/preprints202308.1069.v1

NAV	0.758	0.749-0.790	0.815	0.594

To ensure discriminant validity and distinguishable measurement structures, a discriminant validity check is necessary[30]. Discriminant validity exists when the AVE value of each variable is greater than the square of the correlation coefficients between variables[26]. Table 6 demonstrates that BI, FC, SI, EE, and PE have satisfactory discriminant validity, while the others do not. Overall, 62.5% of the variables in this study exhibited good discriminant validity.

Table 6. Results of discriminant validity tests.

Variable	Mean	S.D.	BI	FC	SI	EE	PE	NAV	UID	SS
BI	4.148	0.691	**0.860**							
FC	4.278	0.668	0.695	**0.758**						
SI	3.833	0.696	0.673	0.622	**0.754**					
EE	4.003	0.540	0.805	0.674	0.574	**0.735**				
PE	4.257	0.664	0.793	0.552	0.585	0.709	**0.805**			
NAV	4.138	0.394	0.492	0.395	0.302	0.409	0.310	**0.771**		
UID	4.350	0.479	0.648	0.538	0.341	0.526	0.681	0.912	**0.741**	
SS	4.048	0.448	0.669	0.567	0.422	0.574	0.646	0.881	0.986	**0.708**

3.3. Hypothesis testing

As shown in Figure 3, among the extended UTAUT model, PE (β=0.40, p<0.001, |t|>1.96), EE (β=0.50, p<0.001, |t|>1.96), and SI (β=0.25, p<0.05, |t|>1.96) were definitely associated with BI, while FC (β=0.18, p>0.05, |t|<1.96) was not associated with it (H1, H2 and H3 were supported; H4 was not supported). In terms of UI characteristics, UID was positively associated with PE (β=0.89, p<0.001, |t|>1.96) and EE (β=0.81, p<0.001, |t|>1.96) (H6 and H7 were succeeded). NAV (β=-0.32, p<0.01, |t|>1.96; β=-0.11, p>0.05, |t|<1.96) was negatively correlated with PE, and was not associated with EE (H8 was supported; H9 was not supported). Path analysis results shown that SS (β=0.15, p>0.05, |t|<1.96) was not correlated with BI (H5 was not supported).

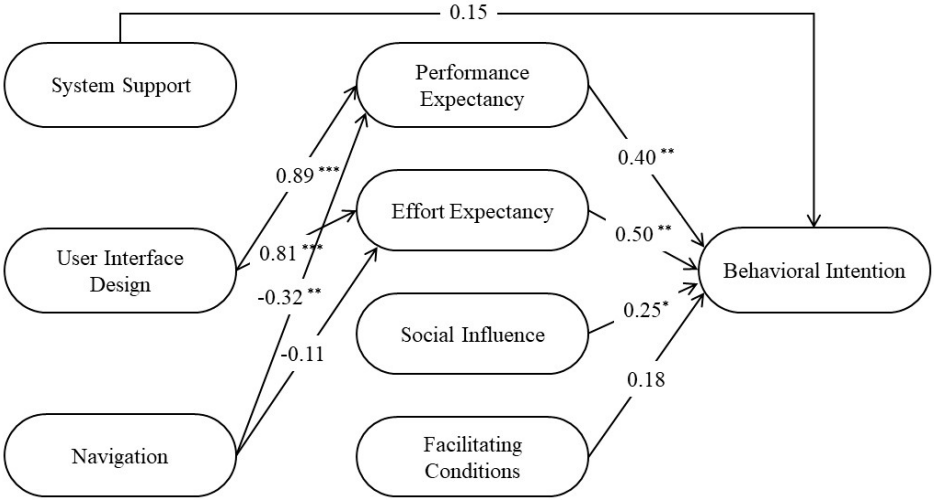

Figure 3. Path analysis model for the hypotheses. ***p<0.001, **p<0.01, *p<0.05.

It can be identified that UID indeed a significant factor to MST acceptance by Chinese older adults. In the light of the path analysis results shown in Figure 3, UID has a comparable impact on PE and EE. In addition, the impact of UID on BI was 0.89 × 0.40 + 0.81 × 0.50 = 0.76, which indicated that UID was an important factor in determining MST acceptance among older adults. Overall, as shown in Table 7, more than 60% of the research hypotheses were consistent with previous studies.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 15 August 2023 doi:10.20944/preprints202308.1069.v1

Table 7. Results of the hypothesis tests. ***p<0.001, **p<0.01, *p<0.05.

Hypotheses	Standardized Regression Coefficient	T-value	Support
H1: PE → BI	0.40	2.983**	Yes
H2: EE → BI	0.50	3.824**	Yes
H3: SI → BI	0.25	2.466*	Yes
H4: FC → BI	0.18	1.911	No
H5: SS → BI	0.15	1.456	No
H6: UID → PE	0.89	7.914***	Yes
H7: UID → EE	0.81	5.054***	Yes
H8: NAV → PE	-0.32	-3.019**	Yes
H9: NAV → EE	-0.11	-0.830	No

4. Discussion

4.1. Theoretical implications

The objective of this study is to examine the impact of UI characteristics on the BI of MST among Chinese older adults, based on an extended UTAUT Model. The proposed model includes four UTAUT factors (PE, EE, SI, and FC) and three UI characteristics (SS, UID, and NAV). The results indicate that 6 out of 9 hypotheses linking UI characteristics and user acceptance show a positive correlation. Additionally, UID significantly influences BI by significantly affecting PE and EE.

4.2. Managerial implications

This study provides two academic implications.

Firstly, regarding the four subjective technology acceptance factors derived from the UTAUT model, some valuable insights can be drawn. The supported H1 demonstrates that planners can utilize the value-added features of MST to enhance older adults' PE. For instance, hospitals can promote the advantages of using MST, such as accessing doctor and department information in advance, facilitating more efficient registration, and saving time. Secondly, the supported H2 highlights the significance of user-friendliness in the interaction with MST. To enhance the user interface's learnability and usability, it is essential to streamline the process of providing users with necessary information. Additionally, compared to other approaches like increasing motivation, enhancing the joyfulness of new users (e.g., optimizing UID) proves to be a more effective way to boost older adults' BI. Thirdly, the supported H3 suggests that governments can employ targeted and large-scale channels, such as elderly communities, where older adults frequently gather for activities and learning, to facilitate efficient word-of-mouth virus transmission. Lastly, the unsuccessful H4 suggests that improving the technical support of existing MST and bridging the digital divide could enhance acceptance among older adults.

This study also provides academic implications regarding the three objective usability factors of UI. Firstly, the supported H6, H7, and H8 indicate that designers should address issues related to UID to reduce the cognitive barriers associated with initial use. It is recommended to enhance the visualization of the UI and provide users with clear SS, such as standardizing and pinning commonly used NAV buttons (e.g., "Back" and "Home"). System developers can also optimize the UI layout to improve user experience. Content levels can be differentiated through adjustments in kerning, line spacing, font size, font weight, color, and other visual elements.

Furthermore, the lack of support for H5 and H9 may be attributed to the existing MST system lagging behind personal terminals. System designers can develop personalized systems that cater to individual habits or preferences in UI interaction.

The deviation observed between the results and the hypothesis could potentially be attributed to the fact that the research was conducted in a single city (Hangzhou, China). It is possible that the cognitive factors of Chinese older adults differ from those of older adults in foreign studies cited in the literature.

4.3. Limitations and further research

There are several limitations that should be acknowledged in this study. Firstly, the survey design is cross-sectional, which may overlook the cognitive differences that arise from the aging process among older adults. Additionally, the research was conducted solely in Hangzhou, China, limiting the generalizability of the MST acceptance factors. Secondly, the reviewed studies included a relatively low number of participants, further impacting the generalizability of the findings. Future studies should aim to collect more extensive data to enhance the flexibility of cognitive research on older adults and improve the completeness of the model structure.

5. Conclusions

The objective of this study is to examine the UI characteristics that impact the BI of MST among older adults in China by extending the UTAUT Model. The proposed model comprises four UTAUT factors, namely PE, EE, SI, and F), along with three UI characteristics, namely SS, UID, and NAV. The study draws three conclusions: (1) PE, EE, SI, and UID are significant variables that influence the BI of MST among Chinese older adults, (2) UID has a positive association with PE and EE, and (3) UID is significantly related to BI. The results demonstrate a positive link between objective UI characteristics and subjective factors derived from the UTAUT Model. This research contributes to a better understanding of the UI characteristics that influence the intention and acceptance of MST among Chinese older adults and highlights the importance of considering the attitudes of elderly individuals. The study provides valuable suggestions for identifying UI design characteristics specific to older adults and improving the MST design process, ultimately contributing to the promotion of MST acceptance and usage among older adults.

Author Contributions: Conceptualization, Qun Wu; Data curation, Qun Wu, Lan Huang and Jiecong Zong; Formal analysis, Jiecong Zong; Investigation, Lan Huang; Methodology, Lan Huang; Project administration, Qun Wu; Resources, Qun Wu; Software, Jiecong Zong; Supervision, Qun Wu; Validation, Qun Wu, Lan Huang and Jiecong Zong; Visualization, Jiecong Zong; Writing – original draft, Qun Wu; Writing – review & editing, Lan Huang. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Zhejiang Province philosophy and social science planning project, grant number 20NDJO084YB.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Research data can be obtained by contacting the corresponding author.

Acknowledgments: Thanks to Yuxin Peng , Yuanfeng Li and Yilin Zhang for their contributions to this study.

Conflicts of Interest: The authors declare no conflict of interest.

Abbreviations

List of abbreviations used in the article (In order of appearance).

MST	Medical Self-service Terminals
BI	Behavioral Inclination
UI	User Interface
UTAUT	Unified Technology Acceptance and Use Theory
TAM	Technology Acceptance Model
IT	Information Technology
PE	Performance Expectancy
EE	Effort Expectancy
SI	Social Influence
FC	Facilitating Conditions
UIQ	the quality of user interface

NAV	navigation
SS	System Support
UID	User Interface Design
CR	Composite Reliability
AVE	Average Variance Extracted

References

1. Zhou M, Zhao L, Kong N, et al. Factors influencing behavior intentions to telehealth by Chinese elderly: An extended TAM model[J]. International journal of medical informatics, 2019, 126: 118-127. https://doi.org/10.1016/j.ijmedinf.2019.04.001.
2. Han Y, He Y, Lyu J, et al. Aging in China: perspectives on public health[J]. Global Health Journal, 2020, 4(1): 11-17. https://doi.org/10.1016/j.glohj.2020.01.002.
3. H. Shang, X. Shi, C. Wang, Research on the Design of Medical Self-service Terminal for the Elderly, 2020, 335–349. https://doi.org/10.1007/978-3-030-50838-8_46.
4. KMcKenzie K, Lowres N, Orchard J, Hespe C, Freedman B, Giskes K. Staff Acceptability and Patient Usability of a Self-Screening Kiosk for Atrial Fibrillation in General Practice Waiting Rooms. Cardiovascular Digital Health Journal. 2022; 3(5):212-219. https://doi.org/10.1016/j.cvdhj.2022.07.073.
5. Barnard Y, Bradley M D, Hodgson F, et al. Learning to use new technologies by older adults: Perceived difficulties, experimentation behaviour and usability[J]. Computers in human behavior, 2013, 29(4): 1715-1724. https://doi.org/10.1016/j.chb.2013.02.006.
6. Renaud K, Van Biljon J. Predicting technology acceptance and adoption by the elderly: a qualitative study[C]//Proceedings of the 2008 annual research conference of the South African Institute of Computer Scientists and Information Technologists on IT research in developing countries: riding the wave of technology. 2008: 210-219. https://doi.org/10.1145/1456659.1456684.
7. Castilla D, Garcia-Palacios A, Miralles I, et al. Effect of Web navigation style in elderly users[J]. Computers in Human Behavior, 2016, 55: 909-920. https://doi.org/10.1016/j.chb.2015.10.034.
8. Hackos J A T, Redish J. User and task analysis for interface design[M]. New York: Wiley, 1998.
9. Sanchiz M, Chevalier A, Amadieu F. How do older and young adults start searching for information? Impact of age, domain knowledge and problem complexity on the different steps of information searching[J]. Computers in Human Behavior, 2017, 72: 67-78. https://doi.org/10.1016/j.chb.2017.02.038.
10. Chen L H, Liu Y C. Affordance and intuitive interface design for elder users with dementia[J]. Procedia CIRP, 2017, 60: 470-475. https://doi.org/10.1016/j.procir.2017.02.015.
11. Venkatesh V, Morris M G, Davis G B, et al. User acceptance of information technology: Toward a unified view[J]. MIS quarterly, 2003: 425-478. https://doi.org/10.2307/30036540.
12. Davis F D, Granić A, Marangunić N. The technology acceptance model 30 years of TAM[J]. Technology, 2023.
13. Marangunić N, Granić A. Technology acceptance model: a literature review from 1986 to 2013[J]. Universal access in the information society, 2015, 14: 81-95. https://doi.org/10.1007/s10209-014-0348-1
14. Usefulness P. Perceived Ease of Use, and User Acceptance of Information Technology[J]. MIS Quarterly, 1989, 13(3): 319-340. https://doi.org/10.2307/249008.
15. Aguilar-Flores S M, Chiang-Vega M M. Factors that determine the use of ICTs in Chile's older adults[J]. Revista científica, 2020 (39): 296-308. https://doi.org/10.14483/23448350.16054.
16. Soh P Y, Heng H B, Selvachandran G, et al. Perception, acceptance and willingness of older adults in Malaysia towards online shopping: a study using the UTAUT and IRT models[J]. Journal of ambient intelligence and humanized computing, 2020: 1-13. https://doi.org/10.1007/s12652-020-01718-4.
17. Yang C C, Li C L, Yeh T F, et al. Assessing Older Adults' Intentions to Use a Smartphone: Using the Meta–Unified Theory of the Acceptance and Use of Technology[J]. International Journal of Environmental Research and Public Health, 2022, 19(9): 5403. https://doi.org/10.3390/ijerph19095403.
18. Rój J. What Determines the Acceptance and Use of eHealth by Older Adults in Poland?[J]. International Journal of Environmental Research and Public Health, 2022, 19(23): 15643. https://doi.org/10.3390/ijerph192315643.
19. H. Park, T. Lee, Adoption of E-Government Applications for Public Health Risk Communication: Government Trust and Social Media Competence as Primary Drivers, Journal of Health Communication. 2018, 23, 712–723. https://doi.org/10.1080/10810730.2018.1511013.

20. Tsai T H, Tseng K C, Wong A M K, et al. A study exploring the usability of an exergaming platform for senior fitness testing[J]. Health Informatics Journal, 2020, 26(2): 963-980. https://doi.org/10.1177/1460458219853369.
21. Kim J C, Saguna S, Åhlund C. Acceptability of a Health Care App With 3 User Interfaces for Older Adults and Their Caregivers: Design and Evaluation Study[J]. JMIR Human Factors, 2023, 10(1): e42145. https://humanfactors.jmir.org/2023/1/e42145/
22. Zhou C, Yuan F, Huang T, et al. The Impact of Interface Design Element Features on Task Performance in Older Adults: Evidence from Eye-Tracking and EEG Signals[J]. International Journal of Environmental Research and Public Health, 2022, 19(15): 9251. https://doi.org/10.3390/ijerph19159251.
23. Šumak B, Pušnik M, Heričko M, et al. Differences between prospective, existing, and former users of interactive whiteboards on external factors affecting their adoption, usage and abandonment[J]. Computers in Human Behavior, 2017, 72: 733-756. https://doi.org/10.1016/j.chb.2016.09.006.
24. Turetken O, Ondracek J, IJsselsteijn W. Influential characteristics of enterprise information system user interfaces[J]. Journal of computer information systems, 2019, 59(3): 243-255. https://doi.org/10.1080/08874417.2017.1339367.
25. Zhang J, Johnson T R, Patel V L, et al. Using usability heuristics to evaluate patient safety of medical devices[J]. Journal of biomedical informatics, 2003, 36(1-2): 23-30. https://doi.org/10.1016/s1532-0464(03)00060-1.
26. Tsai T H, Chang H T, Chen Y J, et al. Determinants of user acceptance of a specific social platform for older adults: An empirical examination of user interface characteristics and behavioral intention[J]. PloS one, 2017, 12(8): e0180102. https://doi.org/10.1371/journal.pone.0180102.
27. CNNIC, Statistical Report on Internet Development in China, 2018. http://www.cnnic.com.cn/IDR/ReportDownloads/202012/P020201201530023411644.pdf
28. Hair J F, Black W C, Babin B J, et al. Multivariate data analysis: Pearson new international edition[J]. Essex: Pearson Education Limited, 2014, 1(2).
29. Bagozzi R P, Yi Y. On the evaluation of structural equation models[J]. Journal of the academy of marketing science, 1988, 16: 74-94. https://doi.org/10.1007/BF02723327.
30. Tan G W H, Ooi K B, Chong S C, et al. NFC mobile credit card: the next frontier of mobile payment?[J]. Telematics and Informatics, 2014, 31(2): 292-307. https://doi.org/10.1016/j.tele.2013.06.002.