How can the hospitality industry help senior homes? The usage of connected health technologies

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Abstract:

The objective of this paper is to extend and apply the technology acceptance model (TAM) to connected healthcare technologies for the elderly. As far as the methodology is concerned, we distributed our survey by post. We targeted elderly people using connected health technologies (assistive alarm, telecare, sensors, etc.) at home and receiving health care at home. We received 213 questionnaires back. As we had several latent variables, we used partial least squares (PLS). The results show that the level of trust in these technologies impacts significantly the perception of usefulness and the degree of intrusiveness. In parallel, the degree of usefulness of these technologies impacts positively elderly people's intention to accept their usage. Finally, one can claim that the perception of the social presence with the use of these technologies impacts positively the degree of perceived usefulness, trust, and intrusiveness.

Keywords: Connected health technologies; Smart homes; TAM; Trust; Social presence; Degree of intrusiveness

1. Introduction

As life expectancy continues to increase in our ageing populations, improving the quality of life for the elderly presents a major challenge for today's society. The numbers of elderly people going into residential care in Switzerland are expected to grow exponentially over the next 20 to 40 years (see Figure 1). The goal of this study is to improve the quality of life of elderly persons by focusing on the use of these connected technologies. We also want to focus on the feeling of social presence (the perception that there is personal human contact) with these connected technologies and the degree of trust of elderly people using these systems. In parallel, we want to identify the relationship between the degree of intrusiveness of these technologies and their acceptation by the elderly. We want to apply the Technology Acceptance

Model (TAM) to connected health technologies designed for elderly people and we also want to extend it by integrating the social presence, trust, and degree of intrusiveness variables to our research model. To the best of our knowledge, this is something new for the academic world in this context.

Figure 1: Evolution of Swiss population over 65 years old

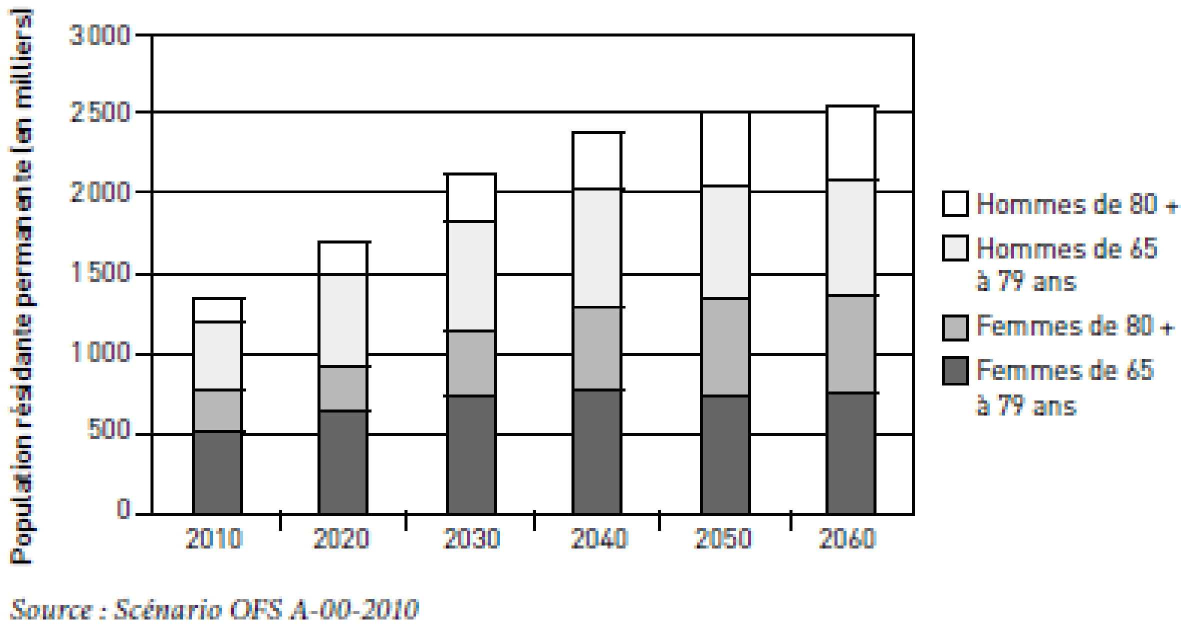


Figure retrieved from Höpflinger et al. (2011)

2. Literature Review

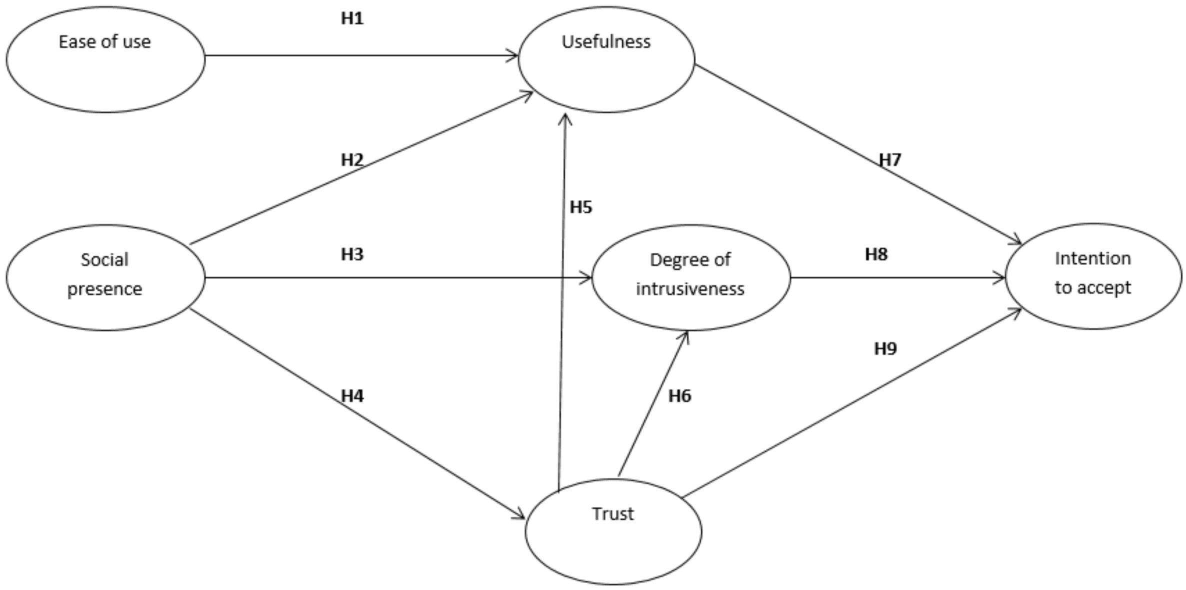
2.1. Technology Acceptance Model applied to connected health technologies

The Technology Acceptance Model (TAM) describes the intention to accept or use a new technology (Davis, 1989). Indeed, the original TAM has been widely used to explain technology uptake. According to TAM, the ease of use of a new technology will influence its perceived usefulness. In parallel, access to personal health information (e.g., medication compliance, daily life activities and vital signals) can potentially be perceived as intrusive, raising privacy concerns (Parra *et al.*, 2013). As carrying alarms, devices or sensors can be perceived as physically obtrusive, they need to be designed carefully (Melenhorst *et al.*, 2004). Awareness of attitudes and factors contributing to the perceived obtrusiveness of technology is important because it can lead to better design and eventually help predict acceptance of technological devices and their successful utilization (Boulanger and Deroussent, 2008). Townsend *et al.* (2011) found that seniors are willing to accept monitoring technologies that improve their autonomy. They found that even video cameras (very intrusive method) were accepted in exchange for increased autonomy. Several studies (Rialle *et al.*, 2008; Ziefle and Wilkowska, 2010), found that the degree of acceptance of intrusive technology varies with the severity of the pathology of the elderly person being supported. Another important issue that we have to consider is the feeling of social presence through the use of these connected technologies. Indeed, social presence is described as the perception that there is personal, sociable, and sensitive human contact (Gefen and Straub, 2004). Several authors identified that the perception of social presence can affect user trust in information provided by a technology (Gefen and Straub, 2004; Hassanein and Head, 2007). According to the same authors, the inclusion of social signs facilitates the building of trust, which is itself one of the determinants of perceived usefulness (Gefen *et al*., 2003). Furthermore, another aspect of trust is the use that will be made of the collected data. Since the system receives information of vital importance, the system has to make sure that the information reaches only the right people. Consequently, smart homes must be designed to protect privacy and should provide reassurance regarding who is going to access the private data that is collected (Portet *et al.*, 2013).

2.2. Our Hypotheses and research model

Figure 2 depicts our research model. We employed the technology acceptance model (TAM), which describes the intention to accept or use a new technology (Davis, 1989). The original TAM has been widely used to explain technology adoption. As connected health technologies are a type of information technology, users' attitudes can be partially explained by TAM (Cyr *et al.*, 2007; Etemad-Sajadi, 2014; Davis, 1989). According to TAM, the ease of use of a new technology will influence its perceived usefulness. In our case, we expanded the original TAM and integrated social presence, trust, and degree of intrusiveness.

Figure 2: Research model
An extended version of TAM applied to connected healthcare technologies



3. Methodology

3.1. Measurement

Responses to the items presented below were used to create this current study's measures and to assess its hypothesized structural model. Response options for each item ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). *Ease of use* and *usefulness* were assessed with items adapted from Steel *et al.* (2009), Cyr *et al.* (2007), and Davis (1989). *Social presence* was assessed with items adapted from Gefen and Straub (2003). *Trust* was assessed with items adapted from Steele *et al.* (2009), Gefen and Straub (2003), Gefen and Straub (2004), and Cyr *et al*. (2005). *Degree of intrusiveness* was assessed with items adapted from Li *et al.* (2002) and Steel *et al.* (2009). Finally, *intention to accept* was assessed with items adapted from Hellier *et al.* (2003).

3.2 Sampling and data collection procedures

For the distribution of the questionnaire, we had the opportunity to reach the clients of the Croix-Rouge (Neuchâtel), Secutel, and Domosafety. We sent the questionnaire by post (with a return stamped envelope) to 605 seniors. We targeted elderly people using Connected Health Technologies (assistive alarm, telecare, sensors, etc.) at home and receiving healthcare at home. As far as the technologies are concerned, our respondents use the traditional assistive alarm and/or sensors installed in the senior's house. We did not focus on more intrusive techniques such as cameras. Overall, we received 213 questionnaires back (34.9%). Considering the profile of the respondents, we were very positively surprised by the high number of respondents. As far as gender is concerned, it was divided with 27.8% male and 72.2% female. The average age of the respondents was 82.10. Finally, 64.9% were living alone, 22.8% with their husband or wife, and 12.3% did not answer if they live alone or not.

3.3 Data analysis method

Structural equation modeling (SEM) was adopted to test the hypotheses due to the fact that the model contains several latent variables. SmartPLS 2.0 was used for the analysis. We employed a bootstrapping method (200 sub-samples) to test the significant level of regression path coefficients (Hair *et al.*, 2011). We used the blindfolding approach (cross-validated communality and redundancy).

4. Results

4.1 Reliability and validity of measures

Table 1 shows that all latent variables have a composite reliability higher than 0.7, confirming that the scale reliabilities have adequate and stable measurement properties. Convergent and discriminant validity are components of a larger measurement concept known as construct validity (Straub *et al.*, 2004). Convergent validity is shown when each measurement item is strongly correlated with its construct. It is usually satisfied by retaining variables whose loadings are high, indicating that they share sufficient variance with their related construct. Discriminant validity is satisfied when each measurement item is weakly correlated with all other constructs except with the one with which it is theoretically associated (Gefen and Straub, 2005). With PLS, convergent and discriminant validities are confirmed if each construct AVE is larger than its correlation with other constructs. Moreover, each item should load more highly on its assigned construct than on the other constructs (Gefen *et al*., 2000; Straub *et al*., 2004). Table 1 shows the intercorrelation of the research constructs. The diagonal of this matrix represents the square root of the average variance extracted. For adequate discriminant validity, the diagonal elements should be significantly larger than the correlation of the specific construct with any of the other constructs and should be at least 0.5 (Fornell and Larcker, 1981). In our case, one can claim that discriminant validity is confirmed and sufficient to support the model.

Table 1: Reliability and discriminant validity

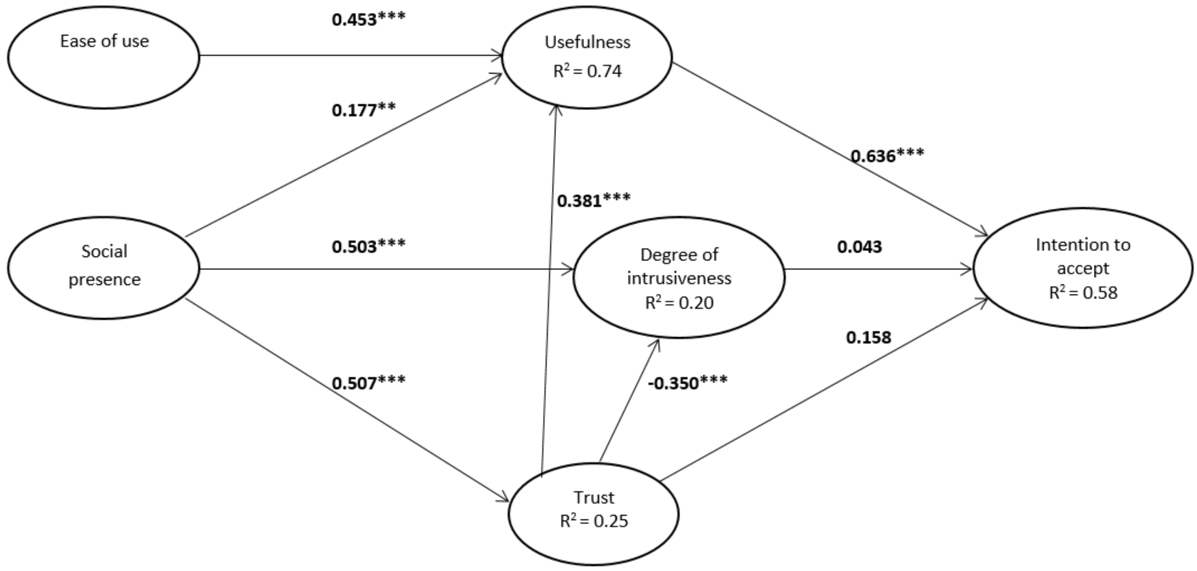
Constructs	**Composite reliability**	**1**	**2**	**3**	**4**	**5**	**6**
1. Ease of use	.86	.87					
2. Usefulness	.88	.77**	.84				
3. Social presence	.81	.33**	.53**	.77			
4. Trust	.89	.66**	.77**	.50**	.86		
5. Degree of intrusiveness	.85	-.11	-.07	.32*	-.11	.86	
6. Intention to accept	.83	.61**	.74	.60**	.63**	-.01	.84

Notes:
* Correlation is significant at the 0.05 level.
** Correlation is significant at the 0.01 level.
a Diagonal: (Average Variance Extracted)$^{1/2}$ = $(\Sigma\lambda_i^2/n)^{1/2}$

4.2 Results and discussion

Figure 3 presents the results of the PLS analysis and the values of different path coefficients. One can observe that ease of use impacts significantly usefulness (γ = 0.453). Hence *H1* is accepted. Social presence also has a significant impact on usefulness (γ = 0.177) even if the path coefficient is lower than for ease of use. In parallel, social presence positively impacts trust (γ = 0.507) and perceived degree of intrusiveness (γ = 0.503). Hence, *H2*, *H3*, and *H4* are all accepted. Regarding the impact of trust on usefulness, one can claim that it is significant (γ = 0.381). Hence, *H5* is also accepted. Overall, 74.3% of usefulness is explained by ease of use, social presence, and trust. For *H6*, we found a significant negative correlation between trust and degree of intrusiveness (γ = -0.350). In other words, the less respondents trust the connected technologies, the more they judge these tools intrusive. Therefore, *H6* is confirmed. Finally, considering the intention to accept the use of these technologies, we found that only the perception of their usefulness impacts it significantly (γ = 0.636). The degree of intrusiveness and trust have no significant impact on intention to accept. *H7* is accepted, while *H8* and *H9* are both rejected.

Figure 3: Results of the PLS analysis



Notes:
** Significant at 0.01 level
*** Significant at 0.001 level

5. Discussion and Conclusion

5.1. Discussion and implications

From our study it was clear that seniors to remain independent and stay at home for as long as possible, health permitting, rather than going into a nursing home. With the emergence of new technologies which can monitor their health and enhance their safety, they may be able to feel safe and secure in their homes as they are able to raise the alarm quickly if they have a fall or need assistance. A smart home is a house equipped with technology that enhances the safety of elderly people at home and monitors their health. Faced with an exploding elderly population and longer life expectancies, seniors increasingly need care and new healthcare technologies can be useful in order to improve their quality of life at home. Indeed, we have to rethink the way that services are provided to the elderly. Seniors expect and desire to stay at home as long as possible instead of going to nursing homes. Continuing home care issue is therefore becoming a pressing objective. Connected technologies can revolutionize this kind of service and expand the range of industries that are covered by the 'hospitality' umbrella.

5.2. Limitation of this study

Our study has several limitations. First, our sample covers a population benefiting from similar Connected Health Technologies. It was difficult to distinguish and interpret the added value of each technology separately. It would be interesting to identify which sets of connected technologies contribute the most to a positive feeling of social presence or trust. Our study is also limited to a population with a similar culture. Further research is needed to understand if the perception of connected health technologies differs according to cultural and psychological characteristics of seniors.

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