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Unlocking the Smart Home: An Examination of Factors Influencing Smart Lock Adoption Intention

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Abstract Smart home technologies are a growing trend, yet little is known about factors that drive their adoption, given the spectrum of potential functional, experiential and esthetic benefits they offer. To address this gap in research, we explore the factorial structure of salient perceived benefits and concerns associated with smart locks, and we examine the effects of the emergent factors on the adoption intention. We find that while potential adopters express a broad range of perceived benefits and concerns associated with smart locks, only the perceived relative advantage of smart locks vis-a-vis conventional locks in providing safety and security is significantly correlated with adoption intention. Our results indicate that this perceived relative advantage is a critical consideration in the adoption of smart home technologies that replace existing solutions.

Keywords: • Smart home technology • Adoption intention • Security • Privacy • Influencing factors •

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1 Introduction

Continued advances in information and communication technologies have led to the introduction of an array of devices seeking to make our homes smarter. Smart Home Technologies (SHTs) span a very broad range of innovative products that can provide security and access controls, home healthcare, smart kitchen and home appliances, and self-regulating heating and cooling systems, among others (Markets and Markets, 2017). Despite the practical importance of this market, there has been relatively little academic research on the factors that influence SHT adoption. In the SHTs ecosystem, smart locks are an important device to study because they not just improve the individual experience with home access control, but also enable new forms of services, e.g. in-home delivery (Amazon, 2018). The commercial market for smart locks is expected to reach $24.4 billion by 2024 (Grand View Research, 2018).

Smart home technologies promise to offer a unique combination of potential functional, experiential, and esthetic benefits to prospective owners. This breadth of benefits is unlikely to be captured by traditional technology adoption models that evolved primarily in the organizational context. These models may also omit key factors affecting the adoption of SHTs. To address this gap, and in recognition of recent calls for context-specific theory development (Hong, Chan, Thong, Chasalow, & Dhillon, 2013), we conduct a three-stage study on user adoption of SHTs by focusing on smart locks. Our research progresses through 1) the elicitation of salient perceived benefits and concerns associated with smart locks, 2) exploratory factor analysis (EFA) of the elicited perceived benefits and concerns, and 3) confirmatory factor analysis (CFA) within a broader nomological network, where we evaluate the effects of the emergent constructs on the smart lock adoption intention.

We find that perceptions related to functional performance (perceived usefulness), which is traditionally emphasized in information technology adoption research (Venkatesh, Thong, & Xu, 2016), has no statistically significant effect on the adoption intention of smart locks. Similarly, effort expectancy (perceived ease of use) is not among the salient considerations voiced by the prospective adopters. We also find that while the prospective smart lock users indicate that specific functional benefits as well as privacy and security concerns may affect the adoption intention, none of these factors had a statistically significant effect on the adoption intention when we examined them within a broader nomological network. Our results reveal that perceived relative advantage of smart locks vis-a-vis traditional locks in assuring security and safety of a home is the most important factor that influences the smart lock adoption intention.

Our study makes several contributions to theory and practice. First, to the best of our knowledge, this study is among the first to develop a comprehensive, context-specific model of factors that influence smart home technology adoption. The results reveal that the constructs traditionally emphasized in technology adoption research (perceived usefulness and perceived ease of use) are not the key salient factors that influence the adoption intention of such technologies. Our findings emphasize that perceived relative advantage compared to installed technology is the key consideration that is predictive of the adoption intention. This finding has important practical implications in that novel features and functions offered by smart locks may do little to promote their adoption, unless the prospective users are convinced that smart locks perform better on the basic functions afforded by the existing technology - assuring security and protection of a home.

2 Theoretical background

Our review of the literature identified two relevant research streams for our study: smart home studies and technology adoption research. A full review of these streams is beyond the scope of the present manuscript. Below we highlight the key studies within each stream that are related to our work.

2.1 Smart home related research

A smart home is defined as “a residence equipped with computing and information technology which anticipates and responds to the needs of the occupants, working to promote their comfort, convenience, security, and entertainment through the management of technology within the home and connections to the world beyond” (Aldrich, 2003). Smart home technologies include sensors, monitors, interfaces, appliances, and other types of connected devices.

Much of the research on the adoption of SHTs has focused on home healthcare applications for the elderly. A number of studies conducted focus groups and surveys with older adult samples to assess the perceived benefits and concerns associated with in-home monitoring technologies: portable blood pressure monitors, fall sensors, cameras, etc. (Coughlin, D'Ambrosio, Reimer, & Pratt, 2007; Courtney, 2008; Demiris, Hensel, Skubic, & Rantz, 2008; Townsend, Knoefel, & Goubran, 2011). The consensus emerging from these studies is that older adults generally view their homes as sanctuaries and they are concerned about the loss of autonomy that may result from the installation of monitoring technologies (Ziefle, Röcker, & Holzinger, 2011). Although the elderly appreciate the potential benefits offered by in-home monitoring technologies, they generally express concern over the loss of privacy associated with the monitoring technology use (Liu, Stroulia, Nikolaidis, Miguel-Cruz, & Rincon, 2016).

Security and privacy concerns have been repeatedly raised in relation to smart technology adoption (Efthymiou & Kalogridis, 2010; Sankar, Rajagopalan, & Mohajer, 2013). For example, an engineering analysis of smart meters revealed that it is possible to infer appliance usage patterns even without knowing the content of the encrypted communications (McKenna, Richardson, & Thomson, 2012).

In summary, much of the prior research on SHTs has been narrowly focused on in-home monitoring devices for the elderly and electric smart meters. The common observations across these contexts suggest that SHT adoption involves weighing perceived functional benefits against the potential loss of privacy and possibly a sense of autonomy. In the next section, we review the key research studies on technology adoption across a broader set of contexts.

2.2 Technology adoption

Factors influencing technology adoption are a central theme in Information Systems research (Venkatesh, Thong, & Xu, 2012; Venkatesh et al., 2016). The Unified Technology Acceptance and Use Theory (UTAUT) elaborates on the Technology Acceptance Model (Davis, 1989) by adding social influence, facilitating conditions, hedonic motivation and price value perceptions as additional constructs that can help explain technology adoption intention in voluntary contexts (Venkatesh et al., 2012).

Although TAM and UTAUT have proven their value across different technology adoption domains (Taiwo & Downe, 2013; Venkatesh et al., 2016), a number of studies have demonstrated that alternative theoretic perspectives are better at uncovering the key factors that influence technology acceptance in specific contexts. For example, Lee & Larsen (2009) revealed that perceived severity of the threat and perceived response self-efficacy were the key determinants of the intention to install anti-malware software. Hsiao (2003) showed that fear and distrust were the key factors that helped explain the adoption intention in an e-marketplace. Baird et al. (2012) demonstrated that a complex set of contingencies influenced the adoption of electronic patient portals by healthcare providers. In summary, although TAM and its successor, UTAUT, offer general frameworks encompassing factors influencing technology adoption intention, research within specific contexts has found that context-specific factors afford a better, more contextualized, understanding of the phenomenological drivers in the respective contexts.

The novelty of smart home technologies may pose challenges for generic theoretical models as they might be unable to capture key contextual factors for technology adoption in this domain. This recognition has prompted recent calls for context-focused research in information systems (Hong et al., 2013). Consequently we draw on the theory of reasoned action as the overarching theoretical framework and we conduct a multi-stage study to develop a comprehensive model of factors that influence smart lock adoption.

3 Methodology

Our study progresses through three stages. First, we elicit salient perceived benefits and concerns. Second, we conduct an exploratory factor analysis to inductively identify the latent constructs that capture the diverse set of beliefs and concerns elicited in the first stage. Third, we conduct a confirmatory factor analysis, wherein we also evaluate the effects of the emergent constructs on the smart lock adoption intention..

For each stage of the study, we recruited a new set of participants using Amazon's Mechanical Turk (AMT). AMT is an online labor market for micro tasks that has received support as a valuable source of research participants in Information Systems (Lowry, D'Arcy, Hammer, & Moody, 2016; Steelman, Hammer, &

Limayem, 2014) and other disciplines (Buhrmester, Kwang, & Gosling, 2011; Holden, Dennie, & Hicks, 2013). To avoid potential cross-cultural effects, we limited the participation to AMT "workers" from the United States. We also restricted the participation in the study to AMT Masters. AMT "grants the Masters Qualification based on statistical models that analyze Worker performance based on several Requester-provided and marketplace data points" (AMT 2018). We relied on Qualtrics, a commercial survey platform, to capture the participants' responses to our surveys in each stage of the study.

For Stage 1, we recruited 24 participants from AMT. We collected basic demographic data and we asked the participants to indicate ownership of different smart home technologies. Since this was a study on adoption intention of smart locks, it was important that all subjects did not already own smart locks. None of the participants in this stage indicated ownership of a smart lock. We exposed participants to a 5-minute commercially produced video describing smart locks and then asked them to share their opinion on the top 5 potential benefits and top 5 concerns associated with smart locks.

Based on the elicited perceived benefits and concerns, we developed a list of 52 items that reflect commonly stated perceived benefits and concerns. The items included such statements as "Having a smart lock in your home would enable you to verify that your house is locked," "Having a smart lock in your home would enable you to let family in remotely in case of emergency," and "I am concerned that a smart lock may malfunction and lock me out."

For Stage 2, we recruited a new group of 150 participants from AMT. We excluded 2 participants who indicated ownership of a smart lock, since the focus of our study is on the pre-adoption stage. We collected the participants' basic demographic information and we exposed them to the same video describing smart locks. We then asked the participants to indicate their agreement or disagreement with the items generated in Stage 1. We used 7-point Likert scales with "1 = Strongly disagree " and "7 = Strongly agree". We performed an exploratory factor analysis and inductively developed a list of latent constructs that captured the themes that emerged from the analysis. Details of this analysis are provided in the results section.

For Stage 3, we recruited a new group of 574 participants from AMT who did not own a smart lock. We excluded 16 responses because of incorrect responses to attention control questions. We collected basic demographic information and exposed the participants to the video describing smart locks. We surveyed the participants on the constructs that emerged in Stage 2 as well as their adoption intention using the established scale from UTAUT (Venkatesh et al., 2012). We then tested the relationships between all the constructs in a theoretically-based nomological network.

4 Results

With the items generated in Stage 1 and the responses collected from the sample in Stage 2, we conducted an exploratory factor analysis following the recommendations of Muthén & Muthén (1998). We performed a principal axis factor analysis with oblique rotation using Mplus software version 8.1. We chose to use the oblique rotation to allow for potential correlations among the latent constructs reflected in the responses to individual survey items. The results suggested a seven-factor solution shown in Table 1 below. The seven-factor model showed a good fit to the covariance patterns in the data: RMSEA = 0.061, CFI = 0.967, TLI = 0.942, SRMR = 0.016.

Table 1: Exploratory factor analysis – factor loadings

Items	1	3	2	4	5	6	7
B1	0.829	0.28	0.168	0.04	-0.055	-0.007	-0.07
B2	0.771	0.259	0.201	0.149	-0.071	-0.002	-0.093
B15	0.89	0.281	0.196	-0.051	-0.11	-0.127	-0.293
B17	0.864	0.206	0.143	0.086	0.01	0.016	-0.24
B18	0.876	0.237	0.129	0.029	-0.089	-0.063	-0.239
B19	0.77	0.182	0.178	0.096	-0.102	-0.041	-0.213
B20	0.782	0.206	0.103	0.041	-0.034	-0.036	-0.204
B22	0.799	0.248	0.13	0.007	-0.011	-0.016	-0.202
B9	0.355	0.882	0.313	-0.287	-0.305	-0.279	-0.224
B11	0.247	0.869	0.324	-0.265	-0.287	-0.267	-0.17
B14	0.278	0.937	0.256	-0.236	-0.291	-0.237	-0.05
B6	0.199	0.305	1.01	-0.092	-0.105	-0.186	0.035
B16	0.223	0.347	0.817	-0.178	-0.165	-0.311	-0.008
C01	0.034	-0.299	-0.075	0.933	0.515	0.667	0.396
C02	-0.035	-0.293	-0.1	0.945	0.541	0.7	0.382
C04	-0.046	-0.327	-0.148	0.931	0.611	0.677	0.376
C05	0.051	-0.24	-0.109	0.868	0.456	0.689	0.258
C06	-0.018	-0.331	-0.116	0.922	0.561	0.689	0.384
C17	-0.061	-0.329	-0.11	0.487	0.871	0.609	0.295
C18	-0.097	-0.236	-0.01	0.489	0.877	0.507	0.291
C19	-0.05	-0.276	-0.091	0.478	0.914	0.522	0.202
C20	-0.076	-0.265	-0.094	0.494	0.95	0.534	0.244
C21	-0.153	-0.321	-0.067	0.49	0.72	0.637	0.336
C22	-0.155	-0.322	-0.161	0.524	0.868	0.603	0.241
C23	-0.136	-0.259	-0.07	0.514	0.91	0.563	0.342
C24	-0.07	-0.298	-0.133	0.51	0.948	0.554	0.261
C08	-0.092	-0.239	-0.125	0.638	0.5	0.806	0.306
C09	-0.11	-0.283	-0.198	0.621	0.62	0.89	0.212
C11	-0.084	-0.306	-0.225	0.685	0.609	0.864	0.275
C12	0.06	-0.33	-0.15	0.683	0.675	0.785	0.232
C13	-0.151	-0.36	-0.246	0.623	0.556	0.826	0.343
C25	-0.205	-0.275	-0.042	0.507	0.453	0.408	0.727
C27	-0.16	-0.239	-0.006	0.443	0.35	0.375	0.762

Following the recommendations of Fabrigar et al., (1999), we examined the content of individual constructs to develop a theoretical foundation for the latent factors that can affect the adoption of smart thermostats. The first factor that emerges from the analysis captures statements related to perceived usefulness reflected in the specific functional affordances of the smart locks. Perceived usefulness is a firmly established factor in the technology adoption research (Venkatesh et al., 2016), however it is notable that the participants in our study focus on the specific affordances of the technology rather than general perceptions of usefulness.

The second factor that emerges from the analysis reflects the perceived relative advantage of smart locks compared to the traditional locks. Relative advantage is a core construct in the Rogers technology diffusion model (Rogers, 2010), however this construct has been generally overlooked in the analysis of factors affecting individual technology adoption intention (Venkatesh et al., 2016).

The third factor captures perceptions related to the specific perceived novel benefits afforded by the smart locks. Among other functions, smart locks can enable remote video monitoring either as a part of the device itself or as an add-on. It is noteworthy that the prospective users appear to be separately evaluating novel benefits of the smart technology independently from the more general perceived usefulness of the locks.

The fourth factor captures user technology malfunction concerns. Smart locks control access to people's homes. Hence, the possibility of a person being locked out because of a smart lock malfunction can be an important consideration. The fifth factor captures privacy related concerns, ranging from personal information collection, e.g. I am concerned that a smart lock would be collecting data about my habits, to unauthorized commercial appropriation of the collected information – I am concerned that data collected by the smart lock may be sold. Information privacy concerns are well established in IS research and research has found that they can impede technology adoption (Hong & Thong, 2013).

The sixth factor captures concerns about the potential weaknesses of smart locks that may expose the owner to additional physical security threats. These concerns span a broad range of potential causes from hardwiring to hacking. The seventh factor captures concerns related to the potential negative effect of technology on others. While technology usefulness for others has been noted previously in the technology adoption research (Brown & Venkatesh, 2005), negative effect of technology on others that could result from one's adoption of technology represents a novel construct. Table 2 summarizes these factors and the corresponding items.

Table 2: EFA results summary

Factor 1: Perceived Usefulness	
B1	Having a smart lock in your home would enable you to let family in remotely in case of emergency
B2	Having a smart lock in your home would enable you to let in service people when you are at work
B15	Having a smart lock in your home would allow you to verify that your house is locked
B17	Having a smart lock in your home would enable you to check the status of the lock
B18	Having a smart lock in your home would enable you to lock the home while away
B19	Having a smart lock in your home would enable you to make sure kids have door locked
B20	Having a smart lock in your home would enable you to lock the door even if you forgot about it
B22	Having a smart lock in your home would enable you to lock the doors far away from home
Factor 2: Perceived Relative Advantage	
B9	Having a smart lock in your home would offer better protection versus conventional locks
B11	Having a smart lock in your home would make you feel safer compared to conventional locks
B14	Having a smart lock in your home would increase the overall security of your home compared to conventional locks
Factor 3: Perceived Novel Benefits	
B6	Having a smart lock in your home would enable you to see who’s at the door
B16	Having a smart lock in your home would enable you to see who enters and leaves

Factor 4: Technology Malfunction Concerns	
C01	I am concerned that a smart lock may not work and I would be locked out
C02	I am concerned that a smart lock may malfunction and lock me out
C04	I am concerned that a smart lock may fail and lock everyone out
C05	I am concerned that a smart lock may stop working and make it impossible to lock the door
C06	I am concerned that a smart lock may refuse to open
Factor 5: Privacy-Related Concerns	
C17	I am concerned that a smart lock may be storing my personal information
C18	I am concerned that a smart lock would be knowing too much about our comings and goings
C19	I am concerned that a smart lock would be collecting data about my habits
C20	I am concerned that data collected by the smart lock may be sold
C21	I am concerned that a smart lock may make it possible to predict hours when people are home or not
C22	I am concerned that a smart lock can lead to information being stolen
C23	I am concerned that a smart lock may lead to sale of information about my location
C24	I am concerned that a smart lock may lead to sale of information about when I am at home
Factor 6: Physical Security Threats	
C08	I am concerned that someone can hardwire a smart lock somehow
C09	I am concerned that a smart lock can give unauthorized access to my house
C11	I am concerned that a smart lock might have security flaws
C12	I am concerned that a smart lock might get hacked
C13	I am concerned that a smart lock can allow someone to break into my house
Factor 7: Negative Effect of Technology on Others	
C25	I am concerned that a smart lock would make it difficult for guests to figure out the temporary keys and be locked out
C27	I am concerned that a smart lock might be hard to use for some people

The factor structure emerging from Stage 2 provided the foundation to test the constructs in a nomological network in Stage 3. Due to space constraints, we are only reporting key information from this analysis. Based on the results from the sample recruited for stage 3 (558 responses, 574 participants recruited minus 16 who failed attention control questions in the questionnaired).

The measurement model showed a good fit: RMSEA = 0.052, CFI = 0.957, TLI = 0.953, SRMR = 0.046. The specified structural model similarly showed a good fit: RMSEA = 0.048, CFI = 0.963, TLI = 0.960, SRMR = 0.041. Figure 1 below summarizes the results of the path analysis in the model.

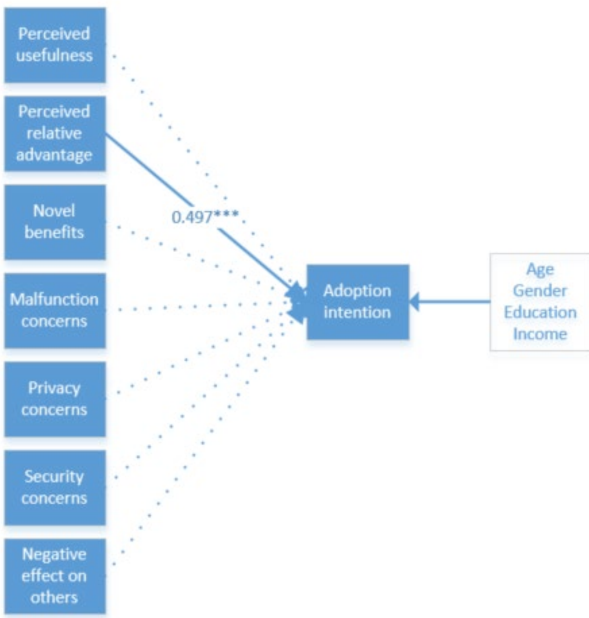

Figure 1 – Structural path model analysis summary

5 Discussion

Smart home technologies represent a diverse set of innovations that promise to transform the experience within our homes, yet relatively little is known about the factors that may influence the adoption of such technologies. Responding to recent calls for context-specific theory development (Hong et al., 2013), we conducted a three-stage study focusing on the perceptions that can affect the adoption of smart locks. In stage 1, we elicited smart lock related perceived benefits and concerns. In stage 2, we conducted exploratory factor analysis to gain insight into the key latent factors that may affect smart lock adoption. In stage 3, we evaluated the effects of the factors identified in stage 2 on the smart lock adoption intention.

In stage 2, we identified the following key factors that can potentially impact the smart lock adoption intention: *perceived usefulness, perceived relative advantage, novel benefits, malfunction concerns, privacy concerns, security concerns, and negative effect of technology on others*. Only one of these factors – *perceived usefulness* – appears in the UTAUT model that is the dominant theoretical perspective in technology adoption research (Venkatesh et al., 2016). *Perceived ease of use*, which is a core construct in the UTAUT model was not among the salient considerations voiced by the participants in our study. These results suggest that generic models developed in the organizational context may offer limited insight into the salient factors that affect the adoption of novel smart home technologies.

Our analysis of the effects of the identified factors (*perceived usefulness, perceived relative advantage, novel benefits, malfunction concerns, privacy concerns, security concerns, and negative effect of technology on others*) on the smart lock adoption intention revealed an unexpected result. We found no statistically significant effect for *perceived usefulness*, and the only factor that had a statistically significant effect on the adoption intention was the *perceived relative advantage*. This construct reflects the beliefs that smart locks would offer greater safety and security vis-à-vis conventional locks.

Perceived relative advantage construct that emerged in our analysis is distinct from the *relative advantage* that is a part of the Rogers model of innovation diffusion in one important respect. Rogers defines relative advantage as "the degree to which an innovation is perceived as better than the idea it supersedes" (Rogers, 2010). The statements that reflect *perceived relative advantage* in our study focus specifically on the extent to which the new technology (smart locks) delivers on the key benefits compared to the incumbent technology (traditional locks) – assuring safety and security of a person's home. The definition offered by Rogers does not elaborate on what "better" means and this has caused confusion in the past studies that attempted to adopt the construct in information systems (Al-Jabri &

Sohail, 2012). Our results indicate that *perceived relative advantage* can be the singular most important construct in predicting innovative technology adoption in the context where it replaces incumbent technology. Therefore, potentials users need to understand the functionality of these devices to promote its adoption. The *novel benefits* construct in our study arguably makes smart locks "better" by expanding the available functionality. However, novel benefits have no effect on the adoption intention in our study.

In conclusion, our study was motivated by the recent calls for context-specific theory in information systems. Our examination of the salient user beliefs that affect the adoption of smart locks as an example of innovative smart home technologies revealed that the dominant models in information systems are unlikely to capture the key salient user considerations in this context. We find that *perceived relative advantage* of the new technology in relation to the core benefits afforded by the incumbent technology is the singular predictor of the smart lock adoption intention in our study. Notably, *novel benefits* have no effect on the adoption intention.

References

Al-Jabri, I. M., & Sohail, M. S. (2012). Mobile banking adoption: Application of diffusion of innovation theory. Journal of Electronic Commerce Research, 13(4), 379–391.

Aldrich, F. K. (2003). Smart homes: past, present and future. In Inside the smart home (pp. 17–39). Springer.

Amazon. (2018). How In-Home Delivery Works. Retrieved from https://www.amazon.com/gp/help/customer/display.html?nodeId=202104360

Amazon AMT. (2018). AMT Frequently Asked Questions. Retrieved from https://www.mturk.com/worker/help

Baird, A., Furukawa, M. F., & Raghu, T. S. (2012). Understanding Contingencies Associated with the Early Adoption of Customer-Facing Web Portals. Journal of Management Information Systems, 29(2), 293–324.

Brown, S. A., & Venkatesh, V. (2005). Model of adoption of technology in households: A baseline model test and extension incorporating household life cycle. MIS Quarterly, 399–426.

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? Perspectives on Psychological Science, 6(1), 3–5.

Conner, M., & Armitage, C. J. (1998). Extending the theory of planned behavior: A review and avenues for further research. Journal of Applied Social Psychology, 28(15), 1429–1464.

Coughlin, J. F., D'Ambrosio, L. A., Reimer, B., & Pratt, M. R. (2007). Older adult perceptions of smart home technologies: implications for research, policy & market innovations in healthcare. In Engineering in Medicine and Biology Society, 2007. EMBS 2007. 29th Annual International Conference of the IEEE (pp. 1810–1815). IEEE.

Courtney, K. L. (2008). Privacy and senior willingness to adopt smart home information technology in residential care facilities. Methods of Information in Medicine, 47(1), 76–81. https://doi.org/10.3414/ME9104

Davis, F. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319–340.

Demiris, G., Hensel, B. K., Skubic, M., & Rantz, M. (2008). Senior residents' perceived need of and preferences for "smart home" sensor technologies. International Journal of Technology Assessment in Health Care, 24(1), 120–124.

Efthymiou, C., & Kalogridis, G. (2010). Smart grid privacy via anonymization of smart metering data. In Smart Grid Communications (SmartGridComm), 2010 First IEEE International Conference on (pp. 238–243). IEEE.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. Psychological Methods, 4(3), 272.

Francis, J. J., Johnston, M., Robertson, C., Glidewell, L., Entwistle, V., Eccles, M. P., & Grimshaw, J. M. (2010). What is an adequate sample size? Operationalising data saturation for theory-based interview studies. Psychology and Health, 25(10), 1229–1245.

Grand View Research. (2018). Smart Lock Market Size Worth $24.20 Billion By 2024. Retrieved from https://www.grandviewresearch.com/press-release/global-smart-lock-market

Holden, C. J., Dennie, T., & Hicks, A. D. (2013). Assessing the reliability of the M5-120 on Amazon's mechanical Turk. Computers in Human Behavior, 29(4), 1749–1754.

Hong, W., Chan, F. K. Y., Thong, J. Y. L., Chasalow, L. C., & Dhillon, G. (2013). A framework and guidelines for context-specific theorizing in information systems research. Information Systems Research, 25(1), 111–136.

Hong, W., & Thong, J. (2013). Internet privacy concerns: an integrated conceptualization and four empirical studies. MIS Quarterly, 37(1), 275–298.

Hsiao, R. L. (2003). Technology fears: Distrust and cultural persistence in electronic marketplace adoption. Journal of Strategic Information Systems, 12(3), 169–199.

Hurley, A. E., Scandura, T. a, Schriesheim, C. a, & Brannick, M. T. (1997). Exploratory and confirmatory factor analysis: Guidelines, issues, and alternatives. Journal of Organizational Behavior, 18(February), 667–683.

Lee, Y., & Larsen, K. R. (2009). Threat or coping appraisal: determinants of SMB executives' decision to adopt anti-malware software. European Journal of Information Systems, 18(2), 177–187. https://doi.org/10.1057/ejis.2009.11

Liu, L., Stroulia, E., Nikolaidis, I., Miguel-Cruz, A., & Rincon, A. R. (2016). Smart homes and home health monitoring technologies for older adults: A systematic review. International Journal of Medical Informatics, 91, 44–59.

Lowry, P. B., D'Arcy, J., Hammer, B., & Moody, G. D. (2016). "Cargo Cult" science in traditional organization and information systems survey research: A case for using nontraditional methods of data collection, including Mechanical Turk and online panels. Journal of Strategic Information Systems, 25(3), 232–240.

Mamonov, S., & Benbunan-Fich, R. (2017). Exploring factors affecting social e-commerce service adoption: The case of Facebook Gifts. International Journal of Information Management, 37(6).

Markets and Markets. (2017). Smart Home Market by Product (Lighting Control, Security & Access Control, HVAC, Entertainment & Other Control, Home Healthcare, Smart Kitchen, and Home Appliances), Software & Service (Behavioral, Proactive), and Geography - Global Forecast to 2023. Retrieved from https://www.marketsandmarkets.com/Market-Reports/smart-homes-and-assisted-living-advanced-technologie-and-global-market-121.html

McKenna, E., Richardson, I., & Thomson, M. (2012). Smart meter data: Balancing consumer privacy concerns with legitimate applications. Energy Policy, 41, 807–814.

Montano, D. E., & Kasprzyk, D. (2015). Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. Health Behavior: Theory, Research and Practice, 95–124.

Muthén, L. K., & Muthén, B. (1998). Mplus. The Comprehensive Modelling Program for Applied Researchers: User's Guide, 5.

Rogers, E. M. (2010). Diffusion of innovations. Simon and Schuster.

Sankar, L., Rajagopalan, S. R., & Mohajer, S. (2013). Smart meter privacy: A theoretical framework. IEEE Transactions on Smart Grid, 4(2), 837–846.

Steelman, Z., Hammer, B., & Limayem, M. (2014). Data collection in the digital age: Innovating alternatives to student samples. MIS Quarterly, 38(2), 355–378.

Taiwo, A. A., & Downe, A. G. (2013). The theory of user acceptance and use of technology (UTAUT): A meta-analytic review of empirical findings. Journal of Theoretical & Applied Information Technology, 49(1).

Townsend, D., Knoefel, F., & Goubran, R. (2011). Privacy versus autonomy: A tradeoff model for smart home monitoring technologies. Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS, 4749–4752.

Venkatesh, V., Thong, J., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. MIS Quarterly, 36(1), 157–178.

Venkatesh, V., Thong, J. Y. L., & Xu, X. (2016). Unified Theory of Acceptance and Use of Technology: A Synthesis and the Road Ahead, 17(5), 328–376.

Ziefle, M., Röcker, C., & Holzinger, A. (2011). Medical technology in smart homes: Exploring the user's perspective on privacy, intimacy and trust. Proceedings - International Computer Software and Applications Conference, 410–415.