Application Fields and Innovative Technology

The Privacy of Voice-Enabled Smart Home Technologies for Older Adults C. Murad, C. Munteanu, C. Maddock, H. Molyneaux. *Gerontechnology* 25(s)

Purpose The engineering advances behind voice-based smart home agents such as Amazon Alexa or Google Home facilitate interactions with many new consumer technologies at home (from smart appliances to full control of one's home, e.g., voice-activated smart door locks). These can greatly benefit older adults (aged 65 and older) in helping them "Age in Place" and live independently at home for longer [6]. However, privacy is becoming a growing concern as voice-based smarthome devices (such as smart speakers, voice-enabled thermostats, security cameras/doorbells, etc.). require the collection of increasing amounts of personal data [1, 2, 3, 4, 7]. This can cause significant concerns and barriers to adoption by older adults [5]. To explore older adults' perspectives on the privacy of voice-based smart home devices, we conducted 2-hour-long interviews and cognitive walkthrough sessions of voice-enabled smarthome appliances (Amazon Echo, Amazon Echo Show, and Alexa-enabled smart thermostat, smart security camera, smart motion sensor, smart door lock, and smart light bulb). Twelve older adults aged 70 to 90 (gender-balanced and with diverse educational backgrounds and tech competencies) participated in these sessions. Through these, we sought to answer two research questions: 1) How do older adults view the threat to their privacy when using smart home agents? And 2) How do older adults' views and perceptions on privacy of voice-based smart home agents affect their adoption of smart home devices and agents? **Method** We employed interviews and cognitive walkthrough of technology probes (in the form of smarthome appliances as described above). Data was collected as audio recordings of the cognitive walkthrough and additional guided interviews. Inductive thematic analysis was used to analyze transcribed recordings. **Results and Discussion** The thematic analysis developed four overarching themes. Theme 1) Mental Models of Voice-Based Smart Home Devices – older adults appreciated the convenience of such devices and their ability to automate tasks, yet conflated the representation of such devices with computers, tablets, and even smartphones, raising concerns about understanding of privacy risks due to higher usage of private data collection (always-on microphones in the home) by smarthome technology. Theme 2) Usage and Adoption of Voice-Based Smart Home Devices – Older adults' adoption of smart home technology is often not an active decision (often facilitated by third parties), prompting reflections of autonomy over adoption of privacy-diminishing tech. Theme 3) Knowledge and Perspectives on Privacy of Voice-Based Smart Home Devices – a general attitude was expressed that their data "was not important to anyone", and thus they weren't concerned if anyone had their private information with the exception of financial information; there was an expressed sense of the inevitability of trading off privacy for the benefits offered by such technology. Theme 4) Privacy Affects Adoption – participants' interest in adopting voice-enabled smart home devices was not connected to their concerns about privacy. The insights obtained through thematic analysis from the interviews and cognitive walkthroughs suggest that older adults may perceive privacy in voice-enabled smarthome tech as a trade-off between utility value and intrusiveness/loss of agency over data. This may inform providers of smart home solutions for aging in place, as well as caregivers and operators of independent assisted living in developing guidelines for the deployment of voice-enabled smart technologies that do not compromise older adults' privacy.

References
1. Acquisti A, Adjerid I, Balebako R, Brandimarte L, Cranor LF, Komanduri S, Leon PG, Sadeh N, Schaub F, Sleeper M, Wang Y. Nudges for privacy and security: Understanding and assisting users' choices online. ACM Computing Surveys (CSUR). 2017 Aug 8;50(3):1-41.
2. Chiasson S, van Oorschot PC, Biddle R. Even experts deserve usable security: Design guidelines for security management systems. In SOUPS Workshop on Usable IT Security Management (USM) 2007 Jul 18 (pp. 1-4).
3. Morrison B, Coventry L, Briggs P. How do Older Adults feel about engaging with Cyber-Security? Human behavior and emerging technologies. 2021 Dec;3(5):1033-49.
4. Payne BD, Edwards WK. A brief introduction to usable security. IEEE Internet Computing. 2008 May 7;12(3):13-21.
5. Peek ST, Wouters EJ, Van Hoof J, Luijkx KG, Boeije HR, Vrijhoef HJ. Factors influencing acceptance of technology for aging in place: a systematic review. International journal of medical informatics. 2014 Apr 1;83(4):235-48.
6. Singh A, Johnson A, Alnizami H, Gilbert JE. The potential benefits of multi-modal social interaction on the web for senior users. Journal of Computing Sciences in Colleges. 2011 Dec 1;27(2):135-41.
7. Zhang-Kennedy L, Chiasson S. A systematic review of multimedia tools for cybersecurity awareness and education. ACM Computing Surveys (CSUR). 2021 Jan 2;54(1):1-39.