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The exploration of users' perceived value from personalization and virtual conversational agents to enable a smart home assemblage– A mixed method approach

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ABSTRACT

Advancements in smart home technologies are beneficial and valuable for both users and firms. Nevertheless, users' acceptance of these applications are considerably influenced by the need for user personalization, complex and dynamic within a smart home environment, and thus, can present limitations. Additionally, the role of a virtual conversational agent, both as an individual entity and as part of a collective network, in the setup and management of various smart home devices warrants further exploration. To investigate the enablers and inhibitors of smart home adoption and the role of virtual conversational agents, a mixed-method design was employed, comprising two studies: a survey of 1403 users (Study 1) and a topic modeling approach based on 355,340 Reddit posts (Study 2). The findings indicate that the usefulness of personalized applications and services, as well as the integration of a virtual conversational agent as a central component, are crucial in facilitating smart home adoption. The empirical analyses provide significant implications for research and practice by extending existing technology acceptance and use models to include smart device assemblages.

1. Introduction

The rapidly growing digital and interconnected world has created distinctive assemblages of services, smart devices and applications for companies and individuals. A smart home, an allegory of such assemblages, consists of connected smart devices designed to enhance a positive experience of individuals' living and their social and economic well-being (Papagiannidis & Marikyan, 2022; Stieglitz et al., 2023). For users, this assemblage of various smart home devices (e.g., devices for: security, water control, convenience) aims to create an adjustable and dynamic home environment highly responsible to users' needs (Hubert et al., 2019). Many established (e.g., Amazon, Google; Samsung) and new companies have entered the market for smart home devices, application and services for two main reasons: first, these devices can command higher prices compared to their non-smart counterparts; and second, product-in-use data with no additional cost. This data provides unprecedented insights into how customers use the devices and thus offers numerous opportunities for companies, including stronger customer engagement, interactivity, and data collection (Borghi & Mariani, 2022; Garrett & Ritchie, 2018).

From a managerial standpoint, value generation for companies and the value perception for users for both mainly linked to the adoption of a smart home assemblage, which involves multifaceted devices and services from various industries (e.g., energy management with thermostats and windows) (Maalsen, 2020). Therefore, adding a consumer-centric perspective, understanding users' perception of not just individual smart devices but the entire assemblage of smart devices to establish a strong value proposition of a smart home is essential (Garrett & Ritchie, 2018). Such a consumer-centric perspective helps to understand better the often very individual and idiosyncratic use of smart technologies. Two key aspects in this context are (1) the perceived value users derive from personalizing their smart applications (Zhang et al., 2023) and (2) the use of virtual conversational agents as potential hub to manage human-object relation associated with the assemblage of smart home devices (Novak & Hoffman, 2019).

First, the ability to personalize smart devices, especially in terms of

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interconnectedness (e.g., adjusting security cameras, door lock and entertainment systems to security needs), can significantly enhance the perceived value and well-being provided by the smart home (Zhang et al., 2023). However, while technology adoption models like Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) and the technology acceptance model (TAM) (Davis et al., 1989) have been used to understand and predict the use patterns of single smart home devices or the general concept of a smart home (Shin et al., 2018), the role of perceived personalization and smart device use across product categories needs further exploration (Garrett & Ritchie, 2018).

Second, virtual conversational agents (VCAs; e.g., Google Nest; Samsung Smart Home; Echo) are potential facilitators of personalization and interconnectedness within smart homes (Kim & Choudhury, 2021). As core components for their capability to manage interconnectedness, virtual conversational agents could significantly increase adoption rates of complex smart home assemblages (Blut et al., 2021). However, the complex functionality of VCAs, ranging from basic tasks to advanced inter-device connectivity and autonomous routine creation, needs to be better understood (Mariani et al., 2023; Novak & Hoffman, 2019).

To address these two key factors for establishing a smart home assemblage, a mixed-method approach with two studies (study 1; quantitative, survey; study 2, qualitative, topic modelling) was employed. Thus, this research aims to contribute by deepening the theoretical and managerial understanding of (1) users' acceptance of technology assemblages across different product and service categories, focusing on the perceived value of personalization (study 1), and (2) users' use of VCAs to establish a smart home assemblage (study 2). The remainder of the paper: a brief review of the literature will introduce three main components with (1) the assemblage theory as theoretical framework to underly the need for investigating a complex assembly of smart technologies, (2) technology acceptance models associated with smart home as research object and (3) the role of virtual conversational agents. Second, after the clarification of the research design as a mixed-method approach, we will describe and discuss the two studies with regard to their theoretical background, hypotheses development, used method and results. Third, a general discussion consisting of theoretical and practical implications is closed with a section on future research based on evaluated limitations of the two studies.

2. Literature review

2.1. Assemblage theory

In the era of IoT, smart devices and applications are increasingly becoming a ubiquitous part of daily life. A crucial factor is their interconnectedness and their capability to communicate with users and other smart objects, applications and services with the use of the internet (Novak & Hoffman, 2019). Here, Hoffman and Novak (2018) applied assemblage theory to offer a way to understand human-object interaction and relationship building associated with smart devices. The assemblage approach especially emphasizes the interconnectedness of users and objects with the whole assemblage and the dynamic development of human-object as well as object-object relations (Hoffman & Novak, 2018; Novak & Hoffman, 2023). According to the assemblage theory, user-object relations and thus experiences with an assemblage of smart devices are enabled or restricted through the users agentic and communal role (Novak & Hoffmann, 2019). In an agentic role, the user is either enabling (e.g., allowing a virtual conversation agent to adjust learned routines) or restricting (e.g., apply only static rules, controlling smart home components separately) the smart device assemblage. In a communal role, the user is either enabled (e.g., improved convenience through automated energy management) or restricted (e.g., decreased convenience through service failures) by the smart device assemblage. However, while literature offers various insights on the development of human- smart object relations (e.g., conversational agents; Hoffman & Novak, 2018), automation processes (Novak & Hoffmann, 2023) or the investigation of human-like relationship building (Novak & Hofmann, 2019), less is known about an assembly of various smart home technologies as a dynamic and complex assemblage enabled as well as restricted through continuous experiences and perception of user-device interactions.

2.2. Technology acceptance of smart technologies

An assembly of smart technologies and applications within a users' home (Maalsen, 2020) can be related to different product categories, such as virtual conversational agents (e.g., Alexa, Google Nest), entertainment (e.g., smart television, smart speaker), security (e.g., surveillance), or energy management (e.g., thermostats; Mamonov & Koufaris, 2020). Thus, the main part of the smart home literature mainly focusses on technological and functional aspects such as ICT and AI for home automation, IoT for home management, residential energy or health care management (Li et al., 2022; Ohlan & Ohlan, 2022).

Adding a user perspective, the value proposition of a smart home is assured not only by the application of single smart home devices separately, but through users' adoption of the assemblage of different smart devices and functionalities. Anchored in information systems research, the general understanding of users' technology use is mainly associated with technology acceptance models (Blut et al., 2021). The longstanding history and impact of technology acceptance models (e.g., TAM, UTAUT) in technology use and acceptance (Venkatesh et al., 2003; 2012) allows for the implementation of potential drivers and inhibitors of a smart home assemblage. Indeed, existing studies already provided indication on various acceptance drivers (e.g., performance expectancy, risk facets) but mainly regarding single smart devices (Kim & Choudhury, 2021; Raff et al., 2024) or a more general understanding of smart home applications (Valencia-Arias et al., 2023). Nonetheless, more detailed knowledge is needed of users' perceptions of a (smart) device assemblage and their interdependencies (Cannizzaro et al., 2020; Sanguinetti et al., 2018) – especially with regard to potential driver of human-object relations (e.g., request for user-centricity, privacy concerns and trust) (Novak & Hoffman, 2019).

2.3. Virtual conversational agents

A (virtual) conversational agent (VCA) such as Siri or Amazon Echo (Alexa) is a software program that has the capability to act and react to verbal statements made by their users (Feng & Buxmann, 2020). Research regarding VCAs is often centered around the design and technological aspects with regards to the functionality of chatbots or interfaces with a focus on user interaction (Feng & Buxmann, 2020). Beyond this, in a smart home, they could play a particular role in monitoring and managing diverse human-smart object and object-object relations (Novak & Hoffman, 2019). In a complex digital environment, a virtual conversational agent can handle a variety of tasks, ranging from playing music to automatically personalizing the user's preferred lighting routines at home. Although, literature offered some insights on the use of conversational agents as service encounter for human-like communication (Van Pinxteren et al., 2020; Raff et al., 2024), empirical research regarding virtual conversational agents in association with an assemblage of smart devices is scarce (Mariani et al., 2023; Novak & Hoffman, 2023; Zhang et al., 2023). It needs further exploration, if users identify and use virtual conversational agents as potential hubs for creating an interconnected smart home assemblage and if virtual conversational agents are used to mimic human-like communication to personalize smart home experiences.

3. Research design

We applied a mixed-method approach (Venkatesh et al., 2013) by conducting two studies to investigate the role of personalization and virtual conversational agents as enablers and crucial parts interconnected and interdependent smart home technologies. Study 1 is based on survey data and investigated new antecedents of users' assemblage perception within a technology acceptance framework. The second study used a topic-modelling approach with a stronger qualitative perspective, to offer insights on the role of virtual conversational agents as the core of user-object relations in managing a users' agentic and communal role regarding the assemblage of smart home devices. This mixed approach and especially the use of topic-modelling to analyze large forms of unstructured data was chosen, to provide different perspectives on the acceptance and use of a dynamic and complex assemblage of smart home devices.

4. Study 1 – Technology acceptance and importance of personalization

4.1. Overview

Study 1 lays the groundwork for an assemblage acceptance model by taking into account that (1) users must accept and utilize a collection of interdependent smart home devices, (2) value perception characteristically arises from activities (facilitating agentic and communal roles) between users and smart home technologies (Hoffman & Novak, 2018), and (3) value perception frequently relies on the perceived personalization of the devices within the assemblage. Thus, Fig. 1 visualizes the assemblage acceptance model, focusing on an intention – behavior model associated with potential assemblage enablers (perceived value from personalization, habit, trust) and assemblage inhibitors (privacy concerns). Additionally, main drivers regarding users' technology acceptance (performance and effort expectancy, enjoyment, facilitating conditions, and price value; (Venkatesh et al., 2012)) are added for controlling their influence on intention and behavior.

4.2. Theoretical background and hypotheses development

4.2.1. Assemblage constructs

4.2.1.1. Intention-behavior. An assembly of smart home devices is linked to a dynamic adoption process of smart technologies with similar assemblage functionalities (e.g., entertainment with smart speaker and television) also with different assemblage functionalities (e.g., energy management with smart windows and appliances with smart fridges) (Maalsen, 2020). To foster a positive smart home experience (e.g., increased convenience, security perception), a crucial necessity is to utilize a users' enabling agentic role not only regarding one specific smart home device, but also towards their intention and actual use of an assemblage of smart home devices (King & He, 2006). Thus,

H1. : The general intention of a user to embed further smart home devices into a smart home assemblage in the future should also be positively related to the users' existing assemblage of smart home devices.

4.2.1.2. Enabler: personalization. The enabling communal role of a smart home assemblage is often connected to a certain level of personalization (Hoffman & Novak, 2018; Yang et al., 2017), which allows smart home applications (e.g., home automation, proactive virtual conversational agent) to adjust to users' needs, their interests, and preferable behavior (Awad & Krishnan, 2006; Chellappa & Sin, 2005). Establishing a collection of smart technologies across various product categories might require enhanced personalized applications and services to ensure a positive experience and to support the user's agentic and communal roles (Novak & Hoffman, 2019). Therefore, users must perceive value from the personalization of their interactions with smart objects to effectively create a smart home assemblage (Novak & Hoffman, 2019).

H2. : The positive relationship between a users' expected intention to acquire more smart applications and the users' established assemblage of smart home devices is explained (mediated) through a users' perceived value from personalization.

4.2.1.3. Enabler: habit. A developed use habit is associated with an increased and continuous use frequency with the respective technology, service or application (Limayem et al., 2007). To establish an assemblage of smart home devices, a continuous use of a particular smart technology (Benbasat & Barki, 2007) could also lead to a further intention of purchasing and other smart home devices in the future (e.g., due to positive experiences with the smart device; Novak & Hoffman, 2019). In consequence, developing a habit with a single smart home application might also support the actual establishment of a smart home assemblage. Thus, we expect an effect from the users' habit for a specific

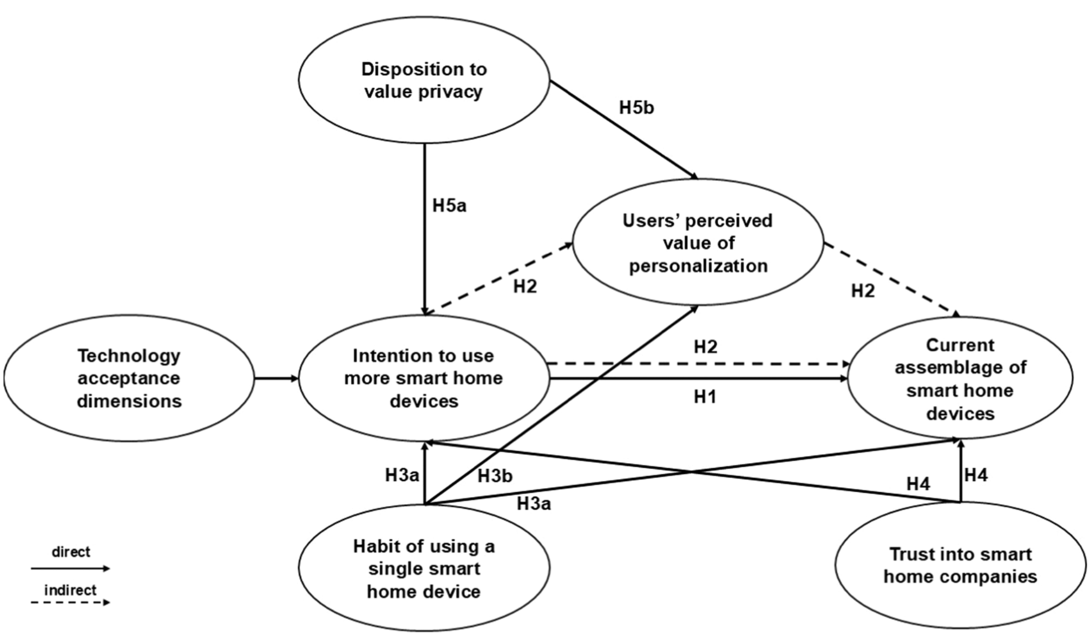

Fig. 1. Conceptual model (Study 1).

smart home technology to the intention and actual behavior of establishing a smart home by adding further smart home devices – also across product categories.

H3a. A users' habit is positively connected to (i) a users' expected intention to use more smart technologies and (ii) the users' established device assemblage.

Furthermore, a users' positive experiences with a smart home device resulting in an increased frequency of usage has the potential to foster a users' agentic role in the willingness to extend his smart device assemblage (Hoffman & Novak, 2018). As an enabling users' agentic and communal role is strongly connected with a positive and more personalized human-smart object relationships (Novak & Hoffman, 2019). Thus, we assume, that:

H3b. The users' habit is positively connected with a users' increased value perception from personalized services and applications.

4.2.1.4. Enabler: trust. Although smart device assemblages offer potential benefits, users are concerned about how companies utilize the data extracted from these technologies (Zuboff, 2023). Smart home applications disrupt the individual understanding of an implicit agreement regarding data versus service transfers common in digital firm-user interactions (e.g., social network services and platforms). This balance is skewed because users often interact with such digitized devices similarly to how they would with traditional ones (e.g., regulating a thermostat), not expecting that companies are continuously gathering data for their algorithms and predictive models (Constantiou et al., 2014). In this scenario, trust in both the products and services and the companies are essential for users to consider and implement a smart home system (Slade et al., 2015).

H4. . Trust into companies offering smart home product and services is positively related to (i) a users' willingness to expand the device assemblage and (ii) the users' established assemblage of smart home devices.

4.2.1.5. Inhibitor: privacy concerns. The necessity of extensive data collection, transfer and analysis associated with information and communication technologies (ICTs) comes also with a cost (Xu et al., 2011). Consumers' awareness of data collection and transfer of smart home devices to not only establish a smart home assemblage, but also to 'support' the business models and product-in-use data collection of companies, also trigger users' data security concerns (Jacobsson et al., 2016). These concerns, if aligned with a users' disposition to value privacy, might lead to a stronger restrictive agentic role of a user (Novak & Hoffman, 2019).

H5a. **:** A users' disposition to value privacy is negatively linked to a users' intention to further engage in extending their device assemblage.

Furthermore, the restrictive agentic role within human – smart object relations triggered through a users' disposition to value privacy is going against the need for an enabling communal role to establish an assembly of smart home technologies (Novak & Hoffman, 2019). The smart home extension is led by users' acceptance for personalized human – object relationships (Hoffman & Novak, 2018), which is strongly associated with data collection, transfer and prediction modelling (Novak & Hoffman, 2023). Therefore, users' increased privacy concerns could be a restraining factor:

H5b. **:** A users' disposition to value privacy is negatively linked to a users' perceived value from personalization.

4.2.2. TAM/UTAUT constructs

Studies on technology use and acceptance have extensively explored this topic, but primarily in the context of individual smart technologies (Tamilmani et al., 2021). Although our study focuses mainly on the potential enablers and barriers to establishing a smart home device assemblage, key constructs from technology acceptance models remain relevant, such as perceived usefulness and perceived ease of use, perceived enjoyment, facilitating conditions and price value, were integrated as additional antecedents (Hess et al., 2014; Venkatesh et al., 2003). By integrating these constructs, the goal was to expand existing models and their antecedents to assess their influence on both the intention to create and the actual creation of a smart home assemblage.

4.3. Methods

4.3.1. Data collection

4.3.1.1. Participants. The data for this research was collected in 4 European countries. Members of a survey panel were invited to participate in the study via a link on an online survey platform. They could earn rewards in the form of a panel-specific points-based system for their participation in the survey. Participants were chosen through the application of three screen-out criteria: their familiarity with the idea of a smart home assemblage; their role as renter or owner of an apartment/house, and the indication if they own at least one smart home device. This procedure led to a total of 1403 completed questionnaires (Mean (age)=48.39, Standard deviation(age)=14.43). A detailed sample description is provided in Table 1.

4.3.2. Survey

The survey contained three main blocks (applied scales for most of the constructs with [1] "totally disagree" to [7] "totally agree"). First, -*intention and behavior constructs* with (a) their intention to use more smart home devices in the future (INT) and (b) their established assemblage of smart home devices (BEH). The behavior of an existing collection of smart home devices was characterized by the cumulative functionality score, which ranged from 1 (representing the usage of a smart home device in a single category) to 6 (representing the usage of various smart home devices across all specified categories). Second, ***assemblage constructs*** with i) three items of a users' value perception of

Table 1
Sample descriptives.

	Sample	
	n	(%)
Sample size	1403	100
Country		
Germany	334	23.8
Denmark	369	26.3
Norway	346	24.7
United Kingdom	354	25.2
Gender		
Female	656	46.8
Male	747	53.2
Employment status		
Employed	778	55.5
Self-employed	60	4.3
Unemployed	64	4.6
Others	501	35.6
Income (in €)		
<1000	162	11.5
1000–2000	353	25.2
2001–3000	372	26.5
3001–4000	236	16.8
>4000	280	19.9
Familiarity with a Smart Home		
So and so	344	24.5
Rather familiar	748	53.3
Very familiar	311	22.2
Situation of living		
Own: house	705	50.2
Rent: house	160	11.4
Own: apartment	160	11.4
Rent: apartment	378	26.9

personalized applications (UVP; Chellappa & Sin, 2005); ii) four items with users' trust towards smart home companies (TRU; Chauduri & Holbrook, 2001), and (c) three items with users' disposition to value privacy (PRIV; Xu et al., 2011). Habit was measured with regard to the usage frequency of a particular smart technology (HAB). Third - ***technology acceptance dimensions*** (adapted from Venkatesh et al., 2012) were used with four items on perceived usefulness (PU), four items on perceived ease of use (PEOU); two items on perceived enjoyment (EJ), three items on a users' perception of their facilitating conditions (FCON), and four items on a users' perceived price value (PVAL) (see Appendix A for a detailed overview of constructs and items).Table 2

4.3.3. Data analysis

Data analysis was conducted by processing a reflective structural equation model with the use of Smart PLS version 4 (SmartPLS4; Hair et al., 2019; Ringle et al., 2024). Partial least square modelling was used due to its suitability for theory exploration, comprehensive prediction and complex modeling (Hair et al., 2019). The PLS algorithm was executed with a path-based weighting scheme. Significance for the outer and inner model parameters was determined through bootstrapping with 5000 subsamples, employing a percentile bootstrap for the confidence interval and a fixed seed for the random number generator (Ringle et al., 2024).

4.4. Results

4.4.1. Evaluation of the measurement model

Outer loadings were appropriate (>.70; Hair et al., 2019), and construct reliability was acceptable, with Cronbach's alphas >.7 (see Table 3). Composite reliability (CR; rho_a) and average variance extracted (AVE) for all latent (reflective) constructs exceeded the minimum threshold values (CR >.7, AVE >.5; Fornell & Larcker, 1981; Hair et al., 2017) (see Table 3). Discriminant validity of the latent constructs was confirmed based on Fornell and Larcker's (1981) criteria and the heterotrait-monotrait ratio of correlations (HTMT) for PLS path models (Henseler et al., 2015; see Table 3). Fourth, in line with Podsakoff et al. (2003), we investigated the potential presence of common method bias in the data. We reviewed the correlation matrix (Table 3) and found that no correlation exceeded the.90 threshold (Bagozzi et al., 1991). For the independent constructs, we conducted full collinearity testing (Kock, 2015), which indicated that all variance inflation factors (VIFs) were below the threshold of 3.3 (see Table. Hence, common method bias was not a concern in this study.

4.4.2. Hypotheses evaluation

First, although expected (H1), no significant direct effect was found for the intention to use more smart home devices in the future (INT) on the established smart device assemblage (BEH; β =.05, p =.14). However, regarding hypothesis 2, the positive relationship between INT and BEH was mediated by users' perceived value from personalization (UVP). While the direct effect from INT to BEH was insignificant, the indirect effect of INT on BEH mediated by UVP was significant (β =.06, p <.01) based on a direct effect of INT to UVP (β =.55, p <.001) and UVP to BEH (β =.10, p <.01). Thus, we can assume a strong mediation of the INT-BEH relationship through UVP (H2). Second, with regard to hypothesis 3, habit (HAB) showed a significant effect on INT (β =.21, p <.001; H3a) and BEH (β =.15, p <.001; H3a), and on UVP (β =.13, p <.001; H3b). Third, with regard to hypothesis 4, trust into smart home companies (TRU) showed a positive relation with INT (β =.12, p <.001; H4), but not with BEH (β =.07, p =.09; H4). Fourth, with regard to hypothesis 5, for users' disposition to value privacy (PRIV), a significant negative effect was found on INT (β = −.06, p <.01; H5a), but not on UVP (β =.11, p <.001; H5b) – contrary to our assumption. Sixth, regarding technology acceptance antecedents, we found significant effects for perceived usefulness (PU; β =.31, p <.001), perceived ease of use (PEOU; β =.10, p =.01), facilitating conditions (FCON; β =.15, p <.001), and price value (PVAL; β =.07, p =.003) on INT. BEH was significantly related to perceived ease of use (PEOU; β = −.09, p =.04) and price value (PVAL; β =.11, p =.001).

To confirm the evaluation and to assess the predictive qualifications of our structural equation model, first the R^2 values show moderate power for INT (R^2 =.52) and UVP (R^2 =.41) with values greater than 0.33 (Chin, 1998) and lower predictive power of BEH (R^2 =.11). Second, the predictive relevance (Q^2>0) for all three constructs (UVP, INT, BEH) was confirmed (Ringle et al., 2024). Third, a cross-validated predicting ability test (CVPAT) (Sharma, 2023) indicated predictive ability of the model and respective constructs by outperforming the indicator average benchmarks (Shmueli et al., 2019).[1] See Table 3 for a detailed overview of results. Furthermore, following Ringle and Sarstedt (2016), we applied an importance-performance map analysis (IPMA), confirming especially the high importance and performance of a users' perceived value from personalization (UVP) with regard to a users' established smart home device assemblage (BEH) (see Appendix B for a visualization of the IPMA).

5. Study 2 – the role of virtual conversational agents in a smart home

5.1. Overview

Following the results from study 1, for establishing a device assemblage, the capability of smart technologies to personalize their application is an important driver. In this regard, the interactive and dynamic nature of VCAs has the potential to play a key role (Jain et al., 2023). Virtual conversational agents are able to enhance users' smart home experiences, as the hub of the assemblage of smart home devices. Not only through their capability to be interactive in a human-smart object relationship, but also through their capability to establish needed smart object – smart object relations (Novak & Hoffman, 2023; Kim & Choudhury, 2021). Thus, study 2 seeks clarification and explores with the use of social media data and topic modelling techniques, if (1) users identify and use virtual conversational agents as potential hubs for creating an assemblage of smart devices and (2) virtual conversational agents are used to adjust and personalize devices, applications and services within a smart home assemblage (Jain et al., 2023).

5.2. Theoretical background and research propositions

According to assemblage theory, both users and virtual conversational agents (VCA) actively participate in shaping the assemblage of smart devices in an agentic as well as communal role, either by extending or by restricting it (Hoffman & Novak, 2018). By focusing on positive experiences leading to extension and empowerment regarding a smart home assemblage, the user will proactively incorporate new applications and services (extension; agentic role), but also allow the assemblage of devices to adjust and develop (empowerment; communal role) (Hoffman & Novak, 2018). As research on assemblage theory in the context of smart home objects and the potential role of VCAs is limited (Novak & Hoffman, 2023), we aim to identify types of human – smart object interaction using large, unstructured social media data and a novel topic modeling approach. The nature of a virtual conversational agent (e.g., because of AI automation, interactivity; Li et al., 2021; Ohlan & Ohlan, 2022) should be suited to act as a hub because of its ability to generate human-like relationships (e.g., personalized interaction, capability to personalize other smart devices, applications and services) (Jain et al., 2023). Thus, we expect to identify two major types of interactions – agentic and communal - to derive the role of a virtual

[1] As the model showed insignificant differences to the linear benchmarks (Shmueli et al., 2019) we have to neglect a strong predictive validity (see Table 3).

Table 2
Measurement model validation and correlation matrix.

	M SD	CA	CR (rho_a)	AVE	PU	PEOU	EJ	FCON	PVAL	PRIV	UVP	TRU	HAB	INT	BEH
PU	4.661.39	.90	.90	.76	**.87**	.63	.49	.61	.57	.17	.79	.53	.39	.65	.24
PEOU	5.16 1.30	.94	.94	.85	.58	**.92**	.32	.87	.46	.11	.65	.42	.37	.57	.16
EJ	4.05 1.54	.71	.84	.77	.39	.28	**.87**	.31	.37	.17	.44	.36	.25	.31	.14
FCON	5.111.27	.88	.89	.81	.55	.79	.26	**.90**	.42	.10	.67	.41	.43	.59	.19
PVAL	4.17 1.37	.92	.94	.86	.52	.44	.31	.39	**.93**	.16	.55	.52	.36	.48	.26
PRIV	4.62 1.39	.83	.90	.75	.14	.10	.11	.09	.14	**.86**	.16	.09	.03	.04	.10
UVP	4.87 1.37	.88	.93	.80	.70	.60	.36	.60	.50	.14	**.90**	.53	.43	.66	.27
TRU	4.70 1.20	.94	.94	.84	.49	.40	.31	.37	.49	.09	.48	**.92**	.33	.48	.22
HAB	4.61 1.59	-	-	-	.37	.36	.21	.41	.36	.03	.40	.32	**-**	.48	.25
INT	5.08 1.54	-	-	-	.62	.55	.28	.56	.46	.04	.62	.47	.48	**-**	.24
BEH	1.96 1.29	-	-	-	.22	.15	.12	.18	.25	.09	.25	.21	.25	.24	**-**

Note: PU = Perceived Usefulness; PEOU=Perceived ease of use; EJ= Enjoyment, FCON= Facilitating conditions, PVAL =Price value, HAB = Habit, PRIV = Disposition to value privacy, UVP = Users' perceived value from personalization, TRU = Trust into companies, INT = Intention to use more smart home devices in the future, BEH = Established smart home device assemblage; SD = Standard deviation, CA = Cronbach's alpha, CR = Composite reliability, AVE = Average variance extracted (boldfaced diagonal = square root; lower part = standardized construct correlations; upper part = heterotrait-monotrait-ratio (HTMT))

Table 3
SEM results for hypotheses resting, variation inflation factor (VIF), predictive power (R2) and capacity (Q2; IA, LM).

DV	R2	Q2	Indicator Average: (Average loss difference/p-value)		Linear Model: (Average loss difference/p-value)
BEH	.11	.09	−0.15 (p<.001)		0.001 (p=.97)
INT	.52	.52	−1.22 (p<.001)		0.01 (p=.67)
UVP	.41	.46	−0.86 (p<.001)		0.24 (p<.001)
IV → DV	**VIF**	**beta**	**p-value**	**Supported**	
H1: INT → BEH	2.15	.05	.14	No	
H2: INT → UVP → BEH	n.a.	.06	.01	Yes (VAF=52.8 %)	
H2: INT → BEH	*2.15*	*.05*	*.14*		
H2: INT → UVP	*1.31*	*.55*	*<.001*		
H2: UVP → BEH	*2.50*	*.10*	*.01*		
H3a: HAB → INT	1.30	.21	<.001	Yes	
H3b: HAB –> BEH	1.39	.15	<.001	Yes	
H3c: HAB → UVP	1.31	.13	<.001	Yes	
H4: TRU → INT	1.50	.12	<.001	Yes	
H4: TRU → BEH	1.54	.06	.09		No
H5a: PRIV → INT	1.03	−.06	.01		Yes
H5b: PRIV → UVP	1.00	.11	.01		No

Note: PU = Perceived Usefulness; PEOU=Perceived ease of use; EJ= Enjoyment, FCON= Facilitating conditions, PVAL =Price value, HAB = Habit, PRIV = Disposition to value privacy, UVP = Users' perceived value from personalization, TRU = Trust into companies, INT = Intention to use more smart home devices in the future, BEH = Established smart home device assemblage; VIF=variation inflation factor; VAF=variance accounted for

conversational agent as core component for the establishment of a smart home device assemblage (Hoffman & Novak, 2018).

First, regarding the user's proactive role in expanding the smart home ecosystem (Hoffman & Novak, 2018), we propose that interactions between humans and smart objects involve the user actively engaging with a specific smart home device through the Voice-Controlled Assistant (VCA). The user provides distinct commands to the VCA, which then performs actions on the selected smart home device, such as opening a window, adjusting the thermostats, or playing a list of songs. As the complexity of these interactions increases—depending on the range and flexibility of the user's proactive role—the VCA acts as a coordinator, managing orders that involve several devices working together to achieve a particular result. For instance, an evening routine set by the VCA might adjust lighting, control the thermostat, and play music across different rooms (RP1).

Second, in terms of a user's facilitating communal role, which boosts the efficiency of a smart home network (Hoffman & Novak, 2018), we suggest that interactions between humans and smart objects involve seamless communication and collaboration among various devices within the smart home, mediated by the VCA. Devices independently exchange information or initiate actions, enhancing the smart home's overall performance. For example, an activity sensor might signal smart lights to automatically turn on when movement is detected in a room. As the system becomes more complex, multiple devices work together within the smart home network under the VCA's guidance. The VCA can manage the actions of different devices to achieve a common goal, such as setting a party mood by coordinating lighting, music, and temperature adjustments (RP2).

5.3. Method

5.3.1. Data collection

5.3.1.1. Reddit. Reddit is a social platform – user-centered – with more than 1.212 million active user worldwide (Statista, 2024). Reddit content (e.g., sub-reddits) are highly user-driven and -friendly as users can open topics, comments and discuss their needs and issues in a pseudo anonymized way (Proferes et al., 2021) and is an often used source for research purposes (Medvedev et al., 2019).

5.3.1.2. Sample. The scrapped data consisted of 355,340 postings (7 year timespan of posts; 2015–2022) from various subreddits in relation to a particular virtual conversational agent – Amazon Echo (i.e., r:/alexa (71.000 members); /amazonecho (139.000 members), and /Alexa_Skills (12.000 members). Posts included content such as technical and social support, exchange of experiences, complaints and future developments.

5.3.2. Creating a word semantic network

To address the role of VCA and their capabilities to adjust communication and interact, study 2 aims to enhance traditional topic modeling techniques such as Latent Dirichlet allocation (LDA; Blei et al., 2003)) by focusing on meaningful word relations than single word counts. This approach involves (1) removing words which are unrelated to each other and (2) emphasizing the activities users talk about in relation to their VCA use. To better seize these activities with fewer isolated words, we concentrate on verbs-noun relations, as they form the main part of a described VCA interactions. See Fig. 2 for the topic-modelling procedure.[2]

After data collection and preprocessing - resulting in 328,754 unique posts - we conducted a key phrase extraction phase (Oyebode, 2022) using the following steps: (1) sentence splitting and tokenization with an adapted version of the Python NLTK tokenize library, (2) Part of Speech (POS) tagging (Santorini, 1990) using the "pos_tag" function from NLTK to assign POS tags to each token, identifying the grammatical role of each word in English; (3) lemmatization with WordNetLemmatizer from NLTK to convert nouns, verbs, adjectives, and adverbs to their root forms (Miller & Fellbaum, 2007); and (4) grammar definition and chunking (Asmuth & Gentner, 2005; Mohapatra et al., 2021) using contextual tag-based methods as opposed to N-Gram methods (Oyebode, 2022). We developed a grammar that allows the word chunker to maintain semantic relationships among words in a sentence. Specifically, the chunker uses the grammar's syntactic structures to extract verbs and nouns related to each other in a tree format. Nouns and verbs that are meaningfully connected within a sentence are identified by the grammar to form key phrases that reflect an action (verbs) and its context (nouns). For instance, in the sentence "Great for checking the weather in the morning," the chunker identified two key phrases: "great for" and "check the weather in the morning," with the latter being selected. We focused on verbs (activities) and nouns (contexts) to identify key phrases relevant to Alexa's actions. After this phase, we accumulated 591,828 key phrases. In the second phase, graph creation and clustering, we established connections among these key phrases, resulting in a word semantic network. Clustering was based on the greedy modularity algorithm (Clauset et al., 2004).

5.4. Results: word semantic network

By exploring the use of virtual conversational agents due to our topic modelling techniques, seven distinct topics were explored. See Table 4 for the top 10 nodes for each topic and Fig. 2 for a visualization of the general word semantic network, where the extracted topics are represented by different colors. Fig. 3

6. Discussion

Assemblage theory suggests that the distinctiveness of a digitized and connected home, along with users' acceptance and use of smart home devices, is not linked to any single assemblage application. Instead, it pertains to the entire device assemblage (Hubert et al., 2019; Novak & Hoffman, 2019). Through a mixed-method approach and two studies, we confirmed the significance of perceived value from personalization and the role of virtual conversational agents (Mariani et al., 2023) in enabling a smart home assemblage. This paper thus not only builds upon technology acceptance models (Hubert et al., 2019) but also provides new insights into how virtual conversational agents serve as crucial facilitators in establishing and enhancing human-smart object relationships within a smart home assemblage (Novak & Hoffman, 2019).

In Study 1, focusing on assemblage theory and constructs, the analysis highlighted the significance of users' perceived value from personalization in mediating the intention and behavior linkage of establishing an assembly of smart technologies (H2). Notably, while there was no significant correlation between the intention to adopt more smart devices and the existing smart home assemblage, the mediation suggests that the growth of a smart home assemblage and the intention to expand it are largely influenced by users' expectations for personalized services and the perceived value these services offer to users. Additionally, habit plays a critical role, as Kim and Malhotra (2005) previously indicated. Our findings confirm that, within a complex smart home assemblage, habit predicts future usage (H3a), but also influence users' perceptions of personalization (H3b). This underscores the emerging role of perceived value from personalization (Chellappa & Sin, 2005) as a novel predictor enhanced by a users' habit.

Furthermore, although trust in firms offering smart home products and applications appears to positively impact a users' willingness to extend the device assemblage, it does not seem to affect an already established smart home assemblage (H4). This suggests that trust is more relevant in the pre-adoption phase where intentions are formed, but less so in the post-adoption phase where trust may already be established. Privacy concerns, often cited as potential barriers to using smart technologies (Awad & Krishnan, 2006; Jacobsson et al., 2016), were not fully supported by our data. We found an expected negative effect of users' privacy concerns on their intention to adopt more smart technologies (H5a), but a positive impact on perceived value from personalization (H5b). This counterintuitive result may relate to the privacy paradox (Awad & Krishnan, 2006; Kim & Malhotra, 2005) or recent advancements in privacy-enhancing technologies (Wu et al., 2011). Finally, our results regarding technology acceptance dimensions align with existing research (Venkatesh et al., 2003; Venkatesh et al., 2011; Venkatesh et al., 2012), emphasizing the importance of users' expectations regarding the value of technology, such as increased convenience or performance. However, within a smart home assemblage, expectations about the overall assemblage and the spillover effects from current experiences with individual smart devices are crucial drivers of intention but do not necessarily predict actual usage. This further highlights the magnitude of personalization in establishing a smart home device assemblage.

In Study 2, analyzing a comprehensive set of Reddit posts, we identified seven distinct topic categories, each reflecting various functions visualizing a human-VCA interaction with regard to a users' agentic (RP1) and communal role (RP2). Cluster 1 (orange) and Cluster 2 (blue) highlight a users' agentic tasks related to particular functions, such as providing time information or playing music. On the other hand, Cluster 3 (purple) covers a wider range of a users' agentic role by focusing on the semantics of interactions, such as how the term 'say' relates to a task. Although all three clusters involve direct interactions with a virtual conversational agent (VCA), they underscore the VCA's critical role in facilitating specific goal-oriented functions (RP1). Particularly, when a VCA performs tasks like playing music, it needs to connect with other devices such as speakers or sound systems, illustrating its role as a hub within the assemblage. Furthermore, Clusters 4 (pink) and 5 (yellow) provide insights into how VCAs are used to personalize user experiences and describe a users' more complex agentic role. Both clusters emphasize commands or changes, pointing to semantic and technical personalization aspects of the smart home assemblage (RP1; Novak & Hoffman, 2019; Smirek et al., 2016).

With regard to RP2, the hub function and thus a users' enabling communal role, which involves linking with other devices to create a network of interconnected services, is prominently featured in Cluster 6 (green) and Cluster 7 (red) (Hubert et al., 2019). In these clusters, users permit the VCA to connect with or add additional smart devices, visualizing a strong communal role to enhance a users' smart home experience (RP2; Hoffman & Novak, 2018). However, the aspect of a more VCA -smart object relations is not strongly established, yet, but shows potential regarding advancements in artificial intelligence techniques (Dwivedi et al., 2021; Mariani & Dwivedi, 2024).

In summary, the empirical analysis in study 2 indicates evidence for the two research propositions that (1) a users' agentic role recognize and utilize virtual conversational agents as central hubs for developing and fostering an assemblage of various smart home devices and (2) a users'

[2] See Kazemi (2023) for a more detailed description of the method including programming structures

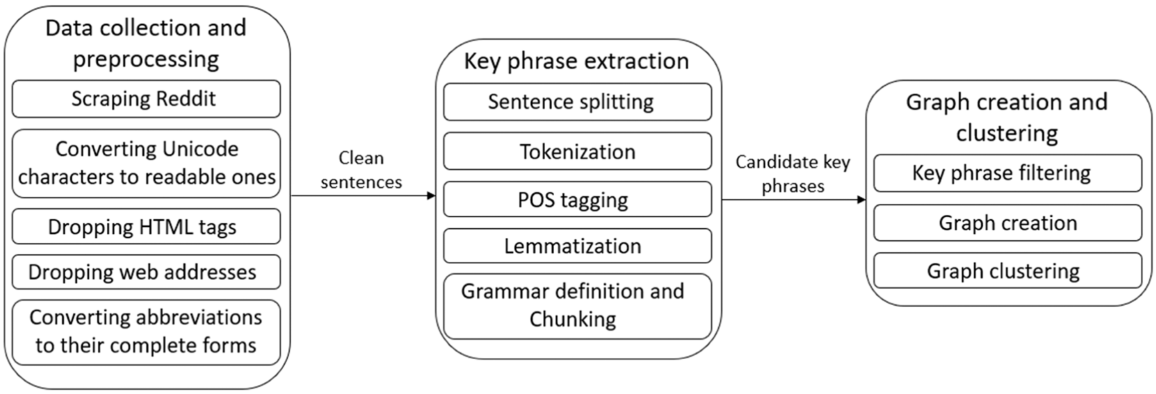

Fig. 2. Word Semantic Network Procedure.

Table 4
Results word semantic network.

#	Colour	Node (Key Phrases)
1	Orange	say time; hear time; turn on time; turn up time; ask time; mention time; pick time; input time; delete time; trigger time
2	Blue	music time; say play; play song; play music; music beatles; music night; music home; song spotify; music spotify; amazon music
3	Purple	say song; say alexa turn on tv; say tv; say skill; say alarm; say pandora; say message; say turn on camera; say alexa; say radio
4	Pink	say command; accept command; need command; command sleep; respond command; manage command; give command; create command; listen command; leave command
5	Yellow	change router; change wifi; change setting; change alexa app; change tv; change name; change input; change channel; change switch name; change station
6	Green	run routine; add music; add purchasing skill; add skill; add tv; add speaker; add account; add routine; guard skill routine; plug routine
7	Red	phone car; connect time; connect hue; connect code; connect living room; connect car; connect alexa app; connect home; connect app; connect bluetooth

communal role, VCA are enabled to automate and adapt to user needs and to tailor smart home experiences. This supports the empirical findings from Study 1, highlighting personalization as an important aspect in strong connection with the uniqueness of a VCA.

6.1. Theoretical contribution and implications

In sum, the combined results of both studies offer novel theoretical implications. First, recent literature on assemblage theory focusses on the development and underlying mechanism of distinctive human-object relations with regard to single smart devices and their functionalities (Novak & Hoffman, 2023). Our research might extend this theory by adding new insights on different aspects and levels of an assemblage, where multiple devices – smart home devices – form a dynamic, complex and interdependent system of interactions. Here, evidently, personalization and the virtual conversational agent play a key role and should be further investigated (Novak & Hoffman, 2023). Second, our research indicates that the users' perceived value from personalization might be a key component and should be added to technology acceptance models within the IoT context. Third, we offered insights on the crucial role of a virtual conversational agent, which might go beyond its functionalities. Our research indicated the potential of a virtual conversational agent to act as enforcer of a smart home assemblage by developing a human-smart object relation which mostly allow an enabling agentic and communal role (Novak & Hoffman, 2019) – especially with the growth of advanced artificial intelligence techniques (Dwivedi et al., 2021; Mariani & Dwivedi, 2024; Mariani & Borghi, 2024).

6.2. Implications for practice

First, valuing an individual smart device does not necessarily indicate the need for personalized services or the integration of devices across different categories within a smart device assemblage. Instead, the appreciation of a smart home, which encompasses multiple smart devices, combined with existing user habits, fosters the perception of value generated through personalization. This finding indicates that users prioritize the overall assemblage over individual components. For manufacturers of smart home devices, this highlights the importance of understanding how their products fit into various assemblages and the need for strategic positioning within potentially competing environments. It is crucial for these companies to grasp the complete customer experience and how their devices interact with others in the smart home (Garrett & Ritchie, 2018). Second, while acceptance dimensions are largely influenced by users' perceptions of personalization value, managing customer experience and ensuring the seamless integration of smart home devices with a virtual conversational agent as a central hub should be another strategic focus.

6.3. Limitations and future research directions

Despite these insights, the study has some limitations that need consideration in future research. First, integrating actual usage data from smart home devices with survey data could provide a deeper understanding of user-smart home interactions (Hubert et al., 2019). Observational studies could offer valuable insights into how users engage with their smart home environments. Second, while this study focused personalization as mediator, future research should explore potential moderator variables. Investigating how different user types (e.g., heavy versus lapsed user) or number of users (e.g., family versus single) (Liao et al., 2009)—might influence outcomes could provide additional valuable insights. Third, study 2 was limited to social media posts. Future research could benefit from analyzing tracking data from smart home devices themselves to study the formation of human-object relationships (Novak & Hoffman, 2019) and how these interactions contribute to customer value.

7. Conclusion

In summary, the project focused on users' value perception from personalization of smart home device use and the specific role of virtual conversational agents to explain adoption of a smart home assemblage. Users are willing to use smart home devices to assemble a smart home, but only if they perceive it as additional value. Second, the virtual conversational agent plays a crucial agentic and communal role within human – smart object relations and for being a central component creating the smart home assemblage. In sum, we hope that our insights lead to a step forward in understanding user behavior in relation to a

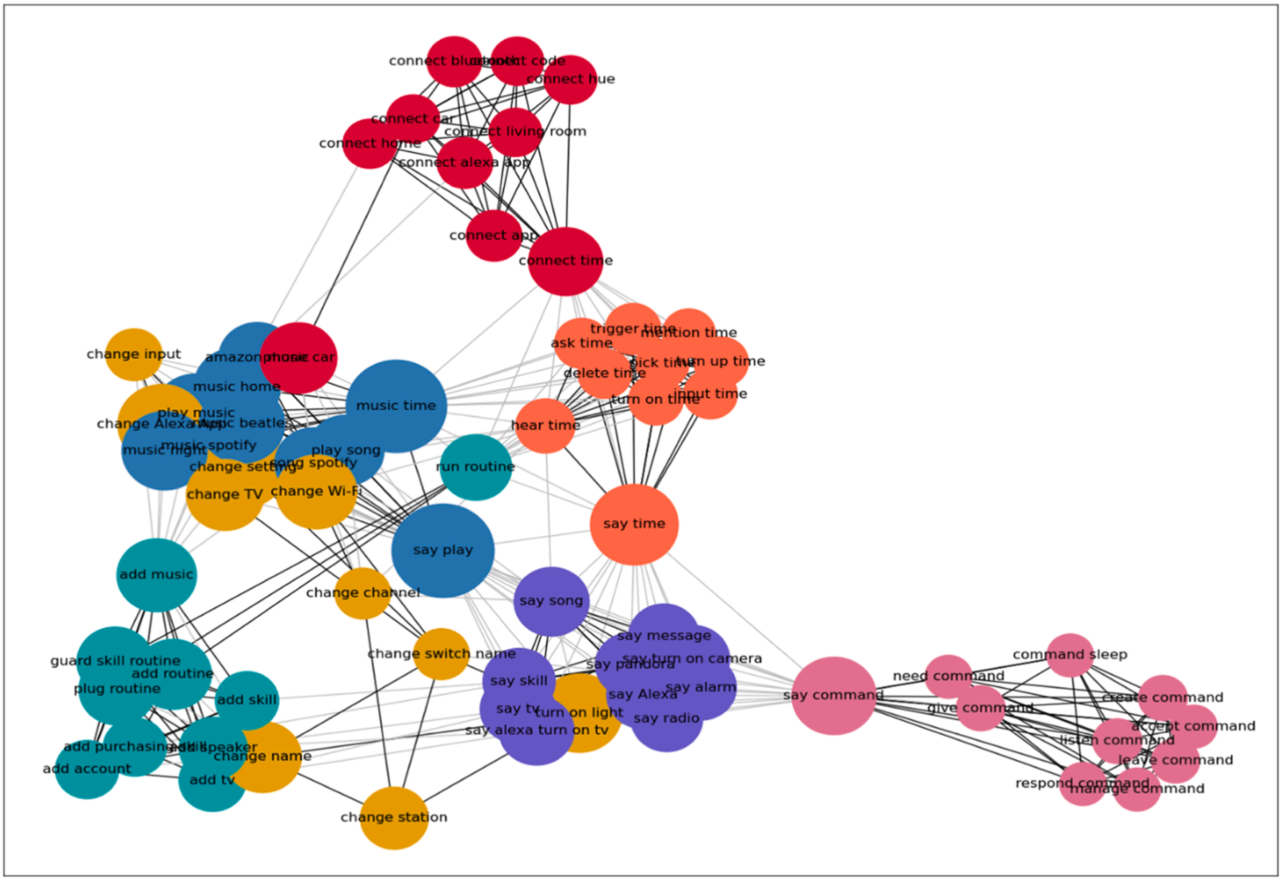

Fig. 3. Visualization of word semantic network.

complex assemblage of information and communication technology from a theoretical and managerial perspective.

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CRediT authorship contribution statement

Andrea Carugati: Writing – original draft, Validation, Supervision, Conceptualization. **Mirja Hubert:** Writing – original draft, Visualization, Methodology, Formal analysis, Data curation. **Marcello Mariani:** Writing – original draft, Conceptualization. **Shahab Kazemi:** Writing – original draft, Visualization, Validation, Methodology, Investigation, Data curation, Conceptualization. **Marco Hubert:** Writing – original draft, Visualization, Validation, Supervision, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

None

Appendix A

Participant information about a smart home assemblage (Hubert et al., 2019):

We use the term to refer to everyday objects and smart devices that connect to the internet, to each other and with humans; not computers, smartphones, or tablets alone. Connected home represents a whole that is more than the sum of the devices due to interactional experience. Smart devices often connect to apps on mobile devices, allowing users to control them remotely. However, they can also operate autonomously on the basis of their internal state and/or the state of the environment. Examples include a Wi-Fi-equipped car, a home thermostat that can be controlled remotely via smartphone while on vacation or reacts to weather conditions, or even a medicine bottle with a Wi-Fi-enabled cap to remind a user when to take a pill.

Table A1
Constructs, items and references

Construct/Items
Perceived Usefulness (PU; 4 items; Venkatesh et al., 2012)
I find the services provided by a connected/smart home device useful.
A connected/smart home device increases my chances of achieving things that are important to me.

(*continued on next page*)

Table A1 (*continued*)

Construct/Items
A connected/smart home device helps me accomplish things more quickly.
A connected/smart home device increases my productivity.
Perceived Ease of Use (PEOU; 4 items; Venkatesh et al., 2012)
Learning how to use a connected/smart home device is easy for me.
My interaction with a connected/smart home device is clear and understandable.
I find a connected/smart home device easy to use.
It is easy for me to become skillful at using a connected/smart home device.
Enjoyment (EJ; 2 items; Venkatesh et al., 2012)
When using smart home technology, I primarily want to have fun.
When using smart home technology, I primarily want to relieve boredom.
Facilitating Conditions (FCON; 4 items[a]; Venkatesh et al., 2012)
I have the resources necessary to use a connected/smart home.
I have the knowledge necessary to use a connected/smart home.
A connected/smart home is compatible with other technologies I use.
Price Value (PVAL; 3 items; Venkatesh et al., 2012)
A connected/smart home device is reasonably priced.
A connected/smart home device is a good value for the money.
At the current price, a connected/smart home device provides good value.
Disposition to value privacy (PRIV; 3 items; Xu et al., 2011)
Compared to others, I am more sensitive about the way online companies handle my personal data.
To me, it is the most important thing to keep my online privacy.
Compared to others, I tend to be more concerned about threats to my personal privacy.
Users' perceived value from personalization (UVP; 3 items[b]; Chellappa & Sin, 2005):
I value smart home technology that is personalized for the device that I use.
I value smart home technology that is personalized for my usage experience preferences
I value smart home technology that acquire my personal preferences and personalize the services and products themselves.
Trust (TRU; 4 items; Chauduri & Holbrook, 2001)
Companies selling smart home technology are… … dishonest/honest.
… untrustworthy/trustworthy.
… unreliable/reliable.
… insincere/sincere.
Habit (HAB; Use Frequency)
Please choose your usage frequency for a connected/smart home device.
Inention (INT)
When I think about my experience with regard to my often used connected/smart home device, I can imagine using other connected devices with my smartphone also for other product categories.
Behavior (BEH)
In which area/product category do you own/owned a smart home/connected home technology? (multiple answers possible, please indicate in chronological order) Control and Connectivity/Comfort and Lightning/Security/Home Entertainment/Energy Management/Smart Appliances

[a]One item "I can get help from others when I have difficulties using a connected/smart home." Was excluded from further analysis, because of a standardized factor loading <.7 (FL =.66)
[b]The construct usually consists of 6 items, but only the selected one refer to individual personalization.

Appendix B

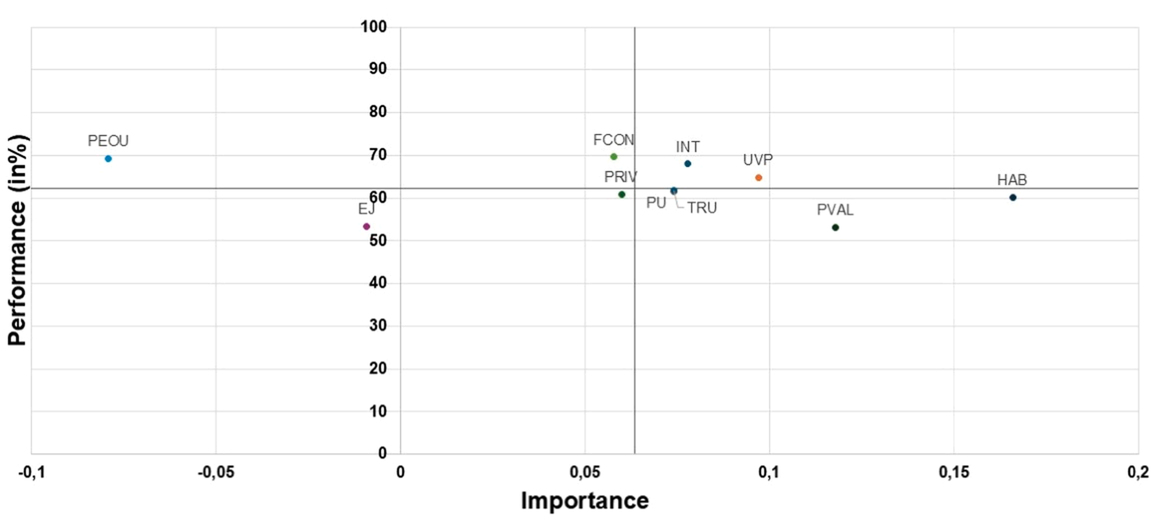

Figure B1. Importance – Performance Map Analysis with BEH as Target Construct.

References

Asmuth, J.A., & Gentner, D. (2005). Context Sensitivity of Relational Nouns. s.l., s.n.

Awad, N. F., & Krishnan, M. S. (2006). The personalization privacy paradox: An empirical evaluation of information transparency and the willingness to be profiled online for personalization. *MIS Quarterly*, 13–28.

Bagozzi, R. P., Yi, Y., & Phillips, L. W. (1991). Assessing construct validity in organizational research. *Administrative Science Quarterly, 36*(3), 421–458.

Benbasat, I., & Barki, H. (2007). Quo vadis TAM? *Journal of the Association for Information Systems, 8*(4), 7.

Blei, D. M., Ng, A. Y., & Jordan, M. I. (2003). Latent dirichlet allocation. *Journal of Machine Learning Research, 3*(Jan), 993–1022.

Blut, M., Chong, A., Tsiga, Z., & Venkatesh, V. (2021). Meta-analysis of the unified theory of acceptance and use of technology (UTAUT): Challenging its validity and charting A research agenda in the red ocean. *Journal of the Association for Information Systems*.

Borghi, M., & Mariani, M. M. (2022). The role of emotions in the consumer meaning-making of interactions with social robots. *Technological Forecasting and Social Change, 182*, Article 121844.

Cannizzaro, S., Procter, R., Ma, S., & Maple, C. (2020). Trust in the smart home: Findings from a nationally representative survey in the UK. *PLoS One, 15*(5).

Chaudhuri, A., & Holbrook, M. B. (2001). The chain of effects from brand trust and brand affect to brand performance: The role of brand loyalty. *Journal of Marketing, 65*(2), 81–93.

Chellappa, R. K., & Sin, R. G. (2005). Personalization versus privacy: An empirical examination of the online consumer's dilemma. *Information Technology and Management, 6*, 181–202.

Chin, W. W. (1998). Commentary: Issues and opinion on structural equation modeling. *MIS Quarterly*, vii–xvi.

Clauset, A., Newman, M. E., & Moore, C. (2004). Finding community structure in very large networks. *Physical Review E, 70*(6), Article 066111.

Constantiou, I. D., Lehrer, C., & Hess, T. (2014). Changing information retrieval behaviours: An empirical investigation of users' cognitive processes in the choice of location-based services. *European Journal of Information Systems, 23*, 513–528.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). Technology acceptance model. *Management Science, 35*(8), 982–1003.

Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., … Williams, M. D. (2021). Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management, 57*, Article 101994.

Feng, S., & Buxmann, P. (2020). My virtual colleague: A state-of-the-art analysis of conversational agents for the workplace (January) *In HICSS*, 1–10.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50.

Garrett, Gregg and Warren Ritchie (2018) Competing in the Connecting World: The Future of Your Industry Is Already Here, LIONCREST PUB, 2018, ISBN 1544511094, 9781544511092.

Hair, J. F., Jr, Matthews, L. M., Matthews, R. L., & Sarstedt, M. (2017). PLS-SEM or CB-SEM: Updated guidelines on which method to use. *International Journal of Multivariate Data Analysis, 1*(2), 107–123.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review, 31*(1), 2–24.

Hess, T. J., McNab, A. L., & Basoglu, K. A. (2014). Reliability generalization of perceived ease of use, perceived usefulness, and behavioral intentions. *MIS Quarterly, 38*(1), 1–28.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*, 115–135.

Hoffman, D. L., & Novak, T. P. (2018). Consumer and object experience in the internet of things: An assemblage theory approach. *Journal of Consumer Research, 44*(6), 1178–1204.

Hubert, M., Blut, M., Brock, C., Zhang, R. W., Koch, V., & Riedl, R. (2019). The influence of acceptance and adoption drivers on smart home usage. *European Journal of Marketing, 53*(6), 1073–1098.

Jacobsson, A., Boldt, M., & Carlsson, B. (2016). A risk analysis of a smart home automation system. *Future Generation Computer Systems, 56*, 719–733.

Jain, S., Basu, S., Ray, A., & Das, R. (2023). Impact of irritation and negative emotions on the performance of voice assistants: Netting dissatisfied customers' perspectives. *International Journal of Information Management, 72*, Article 102662.

Kazemi (2023). Essays on the evolution of human-computer relationship in a smart home context. ⟨https://pure.au.dk/portal/files/361873648/PhD_dissertation_for_print_Shahab_Kazemi.pdf⟩.

Kim, S., & Choudhury, A. (2021). Exploring older adults' perception and use of smart speaker-based voice assistants: A longitudinal study. *Computers in Human Behavior, 124*, Article 106914.

Kim, S. S., & Malhotra, N. K. (2005). A longitudinal model of continued IS use: An integrative view of four mechanisms underlying postadoption phenomena. *Management Science, 51*(5), 741–755.

King, W. R., & He, J. (2006). A meta-analysis of the technology acceptance model. *Information Management, 43*(6), 740–755.

Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration (ijec), 11*(4), 1–10.

Li, W., Yigitcanlar, T., Erol, I., & Liu, A. (2021). Motivations, barriers and risks of smart home adoption: From systematic literature review to conceptual framework. *Energy Research Social Science, 80*, Article 102211.

Liao, C., Palvia, P., & Chen, J. L. (2009). Information technology adoption behavior life cycle: Toward a Technology Continuance Theory (TCT). *International Journal of Information Management, 29*(4), 309–320.

Limayem, M., Hirt, S. G., & Cheung, C. M. (2007). How habit limits the predictive power of intention: The case of information systems continuance. *MIS Quarterly*, 705–737.

Maalsen, S. (2020). Revising the smart home as assemblage. *Housing Studies, 35*(9), 1534–1549.

Mamonov, S., & Koufaris, M. (2020). Fulfillment of higher-order psychological needs through technology: The case of smart thermostats. *International Journal of Information Management, 52*, Article 102091.

Mariani, M., & Dwivedi, Y. K. (2024). Generative artificial intelligence in innovation management: A preview of future research developments. *Journal of Business Research, 175*, Article 114542.

Mariani, M. M., & Borghi, M. (2024). Artificial intelligence in service industries: customers' assessment of service production and resilient service operations. *International Journal of Production Research, 62*(15), 5400–5416.

Mariani, M. M., Hashemi, N., & Wirtz, J. (2023). Artificial intelligence empowered conversational agents: A systematic literature review and research agenda. *Journal of Business Research, 161*, Article 113838.

Medvedev, A. N., Lambiotte, R., & Delvenne, J. C. (2019). The anatomy of Reddit: An overview of academic research. *Dynamics on and of Complex Networks III: Machine Learning and Statistical Physics Approaches, 10*, 183–204.

Miller, G. A., & Fellbaum, C. (2007). WordNet then and now. *Language Resources and Evaluation, 41*, 209–214.

Mohapatra, N., Sarraf, N. & Sahu, S. (2021). Ensemble Model for Chunking. s.l., s.n.

Novak, T. P., & Hoffman, D. L. (2019). Relationship journeys in the internet of things: A new framework for understanding interactions between consumers and smart objects. *Journal of the Academy of Marketing Science, 47*, 216–237.

Novak, T. P., & Hoffman, D. L. (2023). Automation assemblages in the internet of things: Discovering qualitative practices at the boundaries of quantitative change. *Journal of Consumer Research, 49*(5), 811–837.

Ohlan, R., & Ohlan, A. (2022). A comprehensive bibliometric analysis and visualization of smart home research. *Technological Forecasting and Social Change, 184*, Article 121975.

Oyebode, O., et al. (2022). COVID-19 pandemic: Identifying key issues using social media and natural language processing. *Journal of Healthcare Informatics Research*.

Papagiannidis, S., & Marikyan, D. (2022). Environmental sustainability: A technology acceptance perspective. *International Journal of Information Management, 63*, Article 102445.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879.

Proferes, N., Jones, N., Gilbert, S., Fiesler, C., & Zimmer, M. (2021). Studying reddit: A systematic overview of disciplines, approaches, methods, and ethics. *Social Media+ Society, 7*(2), 20563051211019004.

Ringle, C. M., & Sarstedt, M. (2016). Gain more insight from your PLS-SEM results: The importance-performance map analysis. *Industrial Management Data Systems, 116*(9), 1865–1886.

Ringle, Christian M., Wende, Sven, & Becker, Jan-Michael. (2024). SmartPLS 4. Bönningstedt: SmartPLS. Retrieved from https://www.smartpls.com.

Raff, S., Rose, S., & Huynh, T. (2024). Perceived creepiness in response to smart home assistants: A multi-method study. *International Journal of Information Management, 74*, Article 102720.

Sanguinetti, A., Karlin, B., & Ford, R. (2018). Understanding the path to smart home adoption: Segmenting and describing consumers across the innovation-decision process. *Energy Research Social Science, 46*, 274–283.

Santorini, B. (1990). Part-of-speech tagging guidelines for the Penn Treebank Project.

Shin, J., Park, Y., & Lee, D. (2018). Who will be smart home users? An analysis of adoption and diffusion of smart homes. *Technological Forecasting and Social Change, 134*, 246–253.

Sharma, P. N., et al. (2023). Predictive model assessment and selection in composite-based modeling using PLS-SEM: extensions and guidelines for using CVPAT. *European Journal of Marketing, 57*(6).

Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J. H., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: Guidelines for using PLSpredict. *European Journal of Marketing, 53*(11), 2322–2347.

Slade, E. L., Dwivedi, Y. K., Piercy, N. C., & Williams, M. D. (2015). Modeling consumers' adoption intentions of remote mobile payments in the United Kingdom: Extending UTAUT with innovativeness, risk, and trust. *Psychology Marketing, 32*(8), 860–873.

Smirek, L., Zimmermann, G., & Beigl, M. (2016). Just a smart home or your smart home–A framework for personalized user interfaces based on eclipse smart home and universal remote console. *Procedia Computer Science, 98*, 107–116.

Statista. (2024). ⟨https://www.statista.com/forecasts/1309791/reddit-mau-worldwide⟩.

Stieglitz, S., Mirbabaie, M., Deubel, A., Braun, L. M., & Kissmer, T. (2023). The potential of digital nudging to bridge the gap between environmental attitude and behavior in the usage of smart home applications. *International Journal of Information Management, 72*, Article 102665.

Tamilmani, K., Rana, N. P., Wamba, S. F., & Dwivedi, R. (2021). The extended Unified Theory of Acceptance and Use of Technology (UTAUT2): A systematic literature review and theory evaluation. *International Journal of Information Management, 57*, Article 102269.

Valencia-Arias, A., Cardona-Acevedo, S., Gómez-Molina, S., Gonzalez-Ruiz, J. D., & Valencia, J. (2023). Smart home adoption factors: A systematic literature review and research agenda. *Plos One, 18*(10), Article e0292558.

Van Pinxteren, M. M., Pluymaekers, M., & Lemmink, J. G. (2020). Human-like communication in conversational agents: a literature review and research agenda. *Journal of Service Management, 31*(2), 203–225.
Venkatesh, V., Thong, J. Y., Chan, F. K., Hu, P. J. H., & Brown, S. A. (2011). Extending the two-stage information systems continuance model: Incorporating UTAUT predictors and the role of context. *Information Systems Journal, 21*(6), 527–555.
Venkatesh, V., Brown, S. A., & Bala, H. (2013). Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems. *MIS Quarterly*, 21–54.
Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 425–478.
Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS Quarterly*, 157–178.
Wu, K., Zhao, Y., Zhu, Q., Tan, X., & Zheng, H. (2011). A meta-analysis of the impact of trust on technology acceptance model: Investigation of moderating influence of subject and context type. *International Journal of Information Management, 31*(6), 572–581.
Xu, H., Dinev, T., Smith, J., & Hart, P. (2011). Information privacy concerns: Linking individual perceptions with institutional privacy assurances. *Journal of the Association for Information Systems, 12*(12), 1.
Yang, H., Lee, H., & Zo, H. (2017). User acceptance of smart home services: An extension of the theory of planned behavior. *Industrial Management Data Systems, 117*(1), 68–89.
Zhang, F., Pan, Z., & Lu, Y. (2023). AIoT-enabled smart surveillance for personal data digitalization: Contextual personalization-privacy paradox in smart home. *Information Management, 60*(2), Article 103736.
Zuboff, S. (2023). The age of surveillance capitalism. *In Social Theory Re-Wired* (pp. 203–213). Routledge.