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The Impact of Individuals' Motivational System on Attitude toward the Application of Artificial Intelligence in Smart Homes

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Abstract

Smart home and artificial intelligence technologies are developing rapidly, and various smart home systems associated with artificial intelligence (AI) improved the quality of living for people. In the present research, we examine the role of individuals' motivational system in their responses to the application of AI in smart homes. In particular, this research focuses on individuals' prevention motivational system and investigates whether individuals' attitudes toward the application of AI in smart homes differ according to their level of prevention motivation. Specifically, it is hypothesized that individuals with strong (vs. weak) prevention motivation will have more favorable attitudes toward the application of AI in smart homes. Consistent with the hypothesis, the results reveal that the respondents in the strong (vs. weak) prevention motivation reported significantly more favorable attitudes toward the six types of AI-based application in smart homes (e.g., AI-based AR/VR games, AI pet care system, AI robots, etc.). Our findings suggest that individuals' prevention motivational system may be an effective market segmentation tool in facilitating their positive responses to the application of AI in smart homes.

Keywords: *Artificial Intelligence, Smart Home, Motivational System, Attitude*

1. Introduction

With the rapid increase in aging population around the world, smart home technology has gained a lot of attention due to its versatile applications in the area of Internet of Things (IoT) [1]. A smart home is a residence equipped with various technologies such as wired and wireless network systems, actuators, intelligent systems, detecting sensors, and appliances that have available automatic controls to provide inhabitants comfort, convenience, and security [2, 3]. Specifically, a smart home system provides homeowners with various services and applications (e.g., safety and security, automation, entertainment, energy management, etc.) with minimum or no intervention [4]. IoT-based smart homes are already being used in various realms in the households (e.g., safety and security, household appliances, baby and pet monitors, home robots, gardening,

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energy and utilities, lighting, entertainment, health and wellness, clothes and accessories, vehicles and drones, etc.), as shown in Figure 1 [5]. The goal of smart home systems is to efficiently and intelligently coordinate household products and people into a unified system that is able to learn, connect, and adapt to itself [6]. Related studies have discussed the development of smart home systems using advanced technologies, such as artificial intelligence, robotics, natural language understanding (NLU), and immersive technology [7].

In particular, smart home and artificial intelligence technologies are developing rapidly, and various smart home systems associated with artificial intelligence improved the quality of living for people. Artificial intelligence (AI) describes any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals [8]. The ideal state of AI is thinking humanly, thinking rationally, acting humanly, and acting rationally [8]. As stated, AI can be combined with smart home technology to become an innovative tool [9]. Smart homes are utilized in energy management, entertainment system, healthcare, personal robot, intelligent interaction, and security with six clusters of AI functions (i.e., activity recognition, data processing, voice recognition, image recognition, decision making, and prediction making). In the current research, thus, we primarily focus on the application of AI in smart homes. For instsance, AI-based smart speakers of various brands in the market are considered to be the gateway to the control of smart homes in the filed of AI. People interact with AI-based smart speakers through voice, so smart speakers can understand people's needs and perform services that people need.

In addition, most recent studies on smart home systems have examined the effects of one or other of the particular characteristics of the systems on the users' perceptions, adoption, usage intention, and resistance [10]. However, few studies have identified individual characteristics influencing their acceptance and usage of smart home systems [11], even if there are some notable exceptions [12-14]. Hence, we examine the role of individuals' motivational system, particularly prevention motivational system, in their responses to the application of AI in smart homes. That is, we examine whether individuals' attitudes toward the application of AI in smart homes differ depending on their level of preventive system. More specifically, we propose that individuals with strong (vs. weak) prevention motivational system will have more favorable attitudes toward the application of AI in smart homes.

In a practical perspective, given the application of individuals' motivational system may be particularly appealing to marketers because of implementation ease [12-14], it will definitely help the managers to develop several important marketing strategies such as segmentation, targeting, and positioning. First, our research findings will suggest that individuals' chronic preventive system may be an effective segmentation tool in facilitating consumers' positive responses to the AI-based application in smart homes. Some individuals are predisposed to be promotion-motivated, whereas others were raised up to be prevention-motivated. This implies that a segment of the market is comprised of promotion-motivated consumers, while another segment of the market is comprised of prevention-motivated consumers. Thus, marketers can positively influence consumers' attitudes and behavioral intention toward the application of AI in smart homes by assessing the level of target consumers' prevention motivational system (e.g., whether they have relatively low or high prevention motivation). Furthermore, this research will contribute to the positioning and communication of AI-based application in smart homes. Our findings will provide useful practical implications to businesses for promoting the AI-based application in smart homes to target consumers with a prevention motivational system, given that applying the principle of regulatory fit can help to understand consumers' responses to the AI-based application in smart homes. For instance, marketers for the AI-based application in smart homes can try using communication message framing or a stimulus that induces a preventive system among consumers, which may positively impact consumers' attitudes and, subsequently, purchase likelihood. Marketers can also create a shopping situation that matches the consumers' prevention motivational system to induce more favorable

attitude and behavioral intention toward the AI-based application in smart homes.

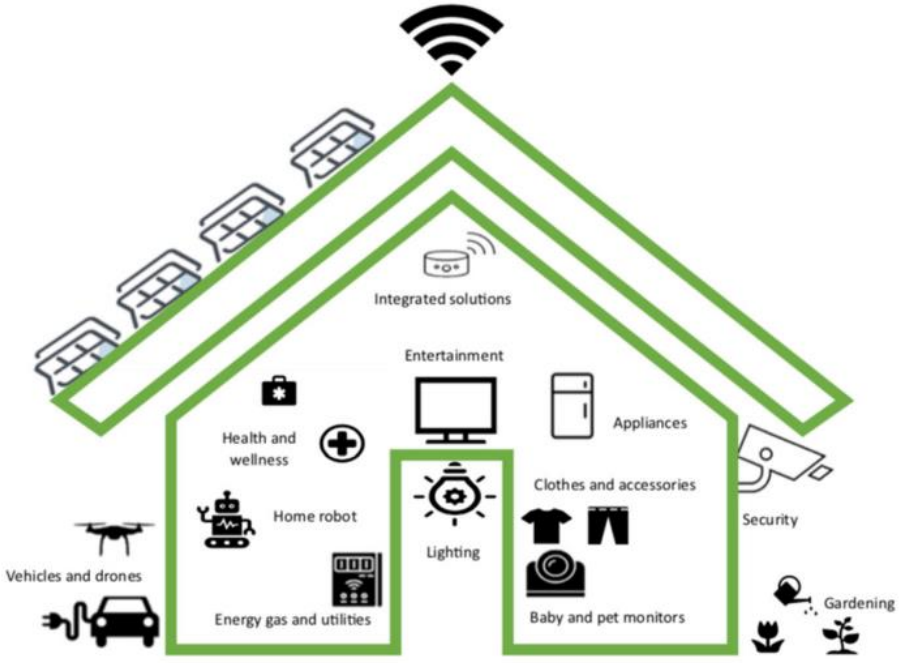

Figure 1. The interconnected categories of smart home technologies [5]

2. Theoretical Background and Hypothesis Development

Researchers propose that artificial intelligence (AI) refers to "programs, algorithms, systems, and machines that demonstrate intelligence" [15], is "manifested by machines that exhibit aspects of human intelligence" [16], and involves machines mimicking "intelligent human behavior" [17]. It relies on several key technologies, such as machine learning, natural language processing, rule-based expert systems, neural networks, deep learning, physical robots, and robotic process automation [18]. AI depends not on its underlying technology but rather its marketing and business applications, such as automating business processes, gaining insights from data, or engaging customers and employees [19].

In the future, AI appears likely to affect marketing strategies, including business models, sales processes, and customer service options, as well as customer behaviors. [20]. For example, consumers do not associate AI applications with autonomous goals [21]. Specifically, consumers are more likely to focus on "how" (rather than "why") the AI application performs; implying that when engaging with AI, consumers will be in a low-level construal mindset [21]. This is because consumers doubt whether AI can understand the importance of engaging in certain consumption behaviors. Prior research has shown that individuals with a prevention motivational system are likely to construe information at a low level, whereas those with a promotion motivational system are inclined to construe information at a high level [22, 23]. Thus, we can predict that when engaging with AI, consumers will have a prevention motivation, given that low- (vs. high-) level construals are associated with a prevention (vs. promotion) motivational system.

How people regulate their goals is elaborated upon in the concept of regulatory focus [24]. Regulatory focus theory refers to the two distinct motivational systems that regulate all goal-directed behaviors—i.e., promotion and prevention motivational systems [24]. Regulatory focus theory proposes that self-regulation affects consumer behavior, which includes cognitive, motivational, and behavioral components [25]. Specifically,

promotion-motivated individuals are oriented toward fulfilling their hopes and aspirations, while prevention-motivated individuals are oriented toward meeting their duties and responsibilities [26]. Furthermore, regulatory fit occurs when an individual's motivational system and the type of information processed are compatible [27]. Previous research demonstrated that compatibility of ad content and consumers' regulatory motivation positively impacted brand attitudes and the perceived effectiveness of the ad [28]. In a similar vein, regulatory focus compatibility of product attributes was found to positively influence product evaluations [29].

As noted, AI may prime a prevention motivational system among consumers for whom AI uses a relatively new technology. Drawing on previous studies, the application of AI in smart homes fits a prevention motivational system. In other words, we predict that individuals with a prevention motivational system will experience fit when they are exposed to the AI-based application in smart homes. Therefore, we propose that individuals with strong (vs. weak) prevention motivational system will have more favorable attitudes toward the application of AI in smart homes.

3. Method

A total of 169 undergraduate students (41.4% females, 58.6% males) at a mid-sized university who ranged in age from 19 to 26 years (median = 21, SD = 1.88) completed the survey. The survey contained items measuring the respondents' chronic prevention motivational system and their overall attitudes toward the application of AI in smart homes, along with their demographic characteristics. First, individuals' motivational systems can be both a trait when one of the motivational systems is dominant within a person and a state elicited by the situation [30]. That is, motivational systems can be treated as a chronic individual difference variable that can also be measured. It can also be situationally induced using different priming tools like feedback messages or task instructions. In this research, we mainly focus on individuals' chronic motivational system. Thus, the respondents' chronic prevention motivational system was measured with a nine-item scale (see Table 1) [31]. Responses were made on 7-point scales with higher scores being associated with stronger prevention motivation (Cronbach's α = .717). The responses were averaged to create a single index of prevention motivational system (M = 4.75, SD = .86). All the respondents were classified as either weak (n = 86; M = 4.08, SD = .52) or strong (n = 83; M = 5.45, SD = .51) prevention motivation group on the basis of a median split (M_{dn} = 4.67; F(1, 167) = 296.604, p = .000).

Then, the respondents were asked to rate their overall attitudes toward the application of AI in smart homes. Regarding the application of AI in smart homes, we focused on six types of AI-based application in smart homes: AI-based augmented reality (AR) or virtual reality (VR) games, AI pet care system, AI robots, AI speakers using holographic characters, automated AI-based laundry sorting/folding, and AI-based smart fridge. The overall attitude toward the application of AI in smart homes was measured using a single-item, 7-point scale [12-14]. Previous research has shown that for doubly concrete constructs, single-item measures demonstrate predictive validity equal to that of multiple-item measures [32]. Researchers may also decide to choose single-item measures in light of their manifold practical advantages [33].

Table 1. Measurement items for prevention motivational system

Construct	Measurement items
Prevention motivational system	I frequently think about how I can prevent failures in my life. I am anxious that I will fall short of my responsibilities and obligations. I often think about the person I am afraid I might become in the future. In general, I am focused on preventing negative events in my life. I often worry that I will fail to accomplish my academic goals.

I often imagine myself experiencing bad things that I fear might happen to me.
I am more oriented toward preventing losses than I am toward achieving gains.
My major goal in school right now is to avoid becoming an academic failure.
I see myself as someone who is primarily striving to become the self I "ought" to be-fulfill my duties, responsibilities, and obligations.

4. Results

ANOVA was performed to test our hypothesis. As noted, we proposed that individuals with strong (vs. weak) prevention motivation will have more favorable attitudes toward the application of AI in smart homes. The results are summarized in Figure 1. In terms of the overall attitude toward the application of AI in smart homes, respondents with strong (vs. weak) prevention motivational system reported significantly higher attitudes toward them, as presented in Table 2 and Figure 2, which supports our prediction.

Specifically, for the AI-based AR/VR games, overall attitude score was significantly higher in the strong (vs. weak) prevention motivation condition (M_{strong} = 5.40, SD = 1.49 vs. M_{weak} = 4.99, SD = 1.53; F(1, 167) = 3.101, p = .080), albeit marginally significant. For the AI pet care system, overall attitude score was significantly higher in the strong (vs. weak) prevention motivation condition (M_{strong} = 4.99, SD = 1.80 vs. M_{weak} = 4.43, SD = 1.63; F(1, 167) = 4.459, p = .036). For the AI robots, overall attitude score was significantly higher in the strong (vs. weak) prevention motivation condition (M_{strong} = 5.17, SD = 1.57 vs. M_{weak} = 4.56, SD = 1.66; F(1, 167) = 6.019, p = .015). For the AI speakers using holographic characters, overall attitude score was significantly higher in the strong (vs. weak) prevention motivation condition (M_{strong} = 4.21, SD = 1.83 vs. M_{weak} = 3.65, SD = 1.73; F(1, 167) = 4.087, p = .045). For the automated AI-based laundry sorting/folding, overall attitude score was significantly higher in the strong (vs. weak) prevention motivation condition (M_{strong} = 6.45, SD = .82 vs. M_{weak} = 6.15, SD = 1.07; F(1, 167) = 4.040, p = .046). For the AI-based smart fridge, overall attitude score was significantly higher in the strong (vs. weak) prevention motivation condition (M_{strong} = 6.05, SD = 1.04 vs. M_{weak} = 5.65, SD = 1.36; F(1, 167) = 4.532, p = .035). Hence, our hypothesis is supported. In sum, respondents with the strong prevention motivational system, as compared to those with the weak prevention motivational system, reported significantly more favorable attitudes toward the six types of AI-based application in smart homes (i.e., AI-based AR/VR games, AI pet care system, AI robots, AI speakers using holographic characters, automated AI-based laundry sorting/folding, and AI-based smart fridge).

Table 2. Hypothesis testing results

	Weak prevention motivation (n = 86)		Strong prevention motivation (n = 83)		*F*-value	*p*-value
	Mean	SD	Mean	SD		
(1) AI-based AR/VR games	4.99	1.53	5.40	1.49	3.101	.080
(2) AI pet care system	4.43	1.63	4.99	1.80	4.459	.036
(3) AI robots	4.56	1.66	5.17	1.57	6.019	.015
(4) AI speakers using holographic characters	3.65	1.73	4.21	1.83	4.087	.045
(5) Automated AI-based laundry sorting/folding	6.15	1.07	6.45	0.82	4.040	.046
(6) AI-based smart fridge	5.65	1.36	6.05	1.04	4.532	.035

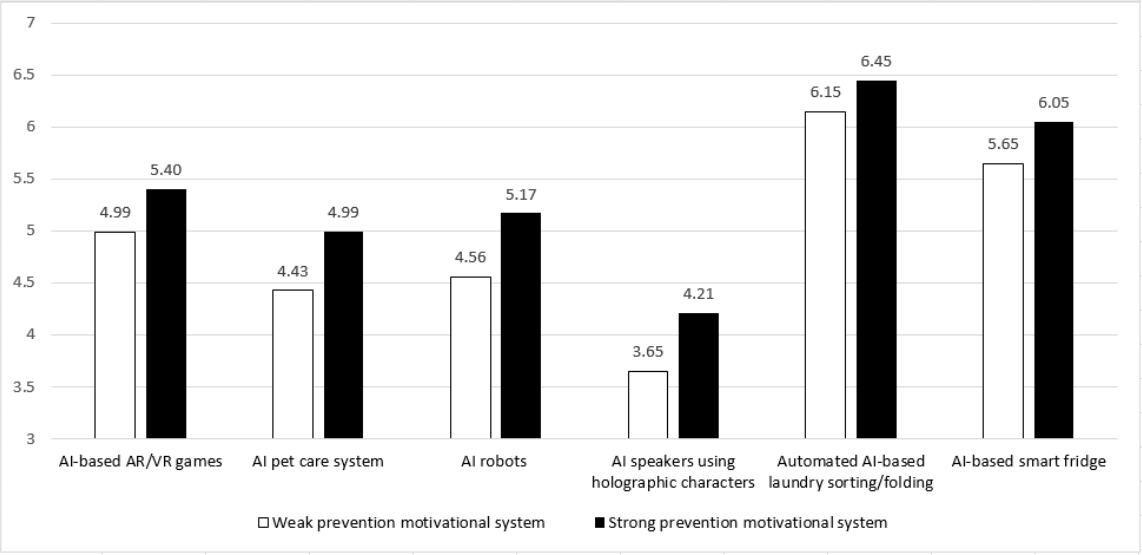

Figure 2. Overall attitude toward the application of artificial intelligence in smart homes

5. Conclusion

This research investigated whether individuals' attitudes toward the application of AI in smart homes vary depending on their level of prevention motivational orientation. Specifically, it was hypothesized that individuals with strong (vs. weak) prevention motivational system will have more favorable attitudes toward the application of AI in smart homes. In support of the hypothesis, it was found that respondents in the strong (vs. weak) prevention motivation reported significantly more favorable attitudes toward the six types of AI-based application in smart homes (i.e., AI-based AR/VR games, AI pet care system, AI robots, AI speakers using holographic characters, automated AI-based laundry sorting/folding, and AI-based smart fridge).

In a theoretical perspective, we extend previous findings by showing the impact of individuals' prevention motivational system on their attitudes in the context of the AI-based application in smart homes. In a practical perspective, this research shows that individuals' motivational system will definitely help the managers to develop several important marketing strategies such as segmentation, targeting, and positioning. Specifically, first, individuals' chronic motivational system can be a useful segmentation variable for identifying consumers and effectively targeting them. Many marketing programs do not use segmentation approaches effectively either because they send the same message to everyone or because they use segmentation criteria (e.g., gender, age, and location) that are not always predictive of appropriate interventions. Thus, marketers can segment their consumers based on chronic motivational system and then tailor the message to their consumers, given the application of individuals' motivational system may be particularly appealing to marketers because of implementation ease. Some individuals are predisposed to be promotion-motivated, whereas others were raised up to be prevention-motivated. This implies that a segment of the market is comprised of promotion-motivated consumers, while another segment of the market is comprised of prevention-motivated consumers. Then, how will a manager identify his/her target customers as relatively strong or weak prevention motivation? For example, managers may frequently go for an online survey with a motivational system questionnaire to understand the prevention motivational system of existing and new customers. Then, they can understand the prevention motivational system of the customers through median split process as mentioned in the analysis section of this research.

Moreover, since prevention motivational system may be situationally induced by different priming tools

like feedback messages or task instructions, marketers could manipulate consumers' motivational system. For instance, marketers can induce consumers' prevention motivational system temporarily and situationally by their choice of the media and message context such as the type of TV programs to yield consumers' more favorable attitude and behavioral intention toward the AI-based application in smart homes. Furthermore, our findings provide useful practical implications to businesses for promoting the AI-based application in smart homes to target consumers with a higher prevention motivation. Given that applying the principle of regulatory fit can help to understand consumers' responses to the AI-based application in smart homes, consumers' attitude and behavior intention toward the AI-based application in smart homes can be influenced when they are exposed to communication messages that are framed to correspond with their motivational system. That is, framing a communication message in agreement with consumers' motivational system positively influences the consumers' attitudes and purchase intentions toward the AI-based application in smart homes. As noted, our findings demomstrate that consumers with strong prevention motivational system show a greater attitude toward the AI-based application in smart homes. Hence, marketers may use their resources more effectively by focusing on prevention-motivated consumers and communicating about the AI-based application in smart homes through the prevention-framed messages. Marketers can also create a shopping situation that matches the consumers' prevention motivational system to induce consumers' more favorable attitude and behavioral intention toward the AI-based application in smart homes.

Although this research has some important implications for academic researchers and practitioners, it is not without limitations. First, it would be good for future research to examine if the findings are applicable to other types of the AI-based application in smart homes. Second, many prior studies on the motivational system examined the role of the chronic and activated motivational system at the same time. Hence, both chronic motivational system and situationally induced motivation should be included in the future research. Third, instead of student samples, a more representative sample could enhance the generalizability of the findings. Finally, future research should consider other factors affecting individuals' attitudes toward the application of AI in smart homes.

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