Asia Pacific Journal of Information Systems
Vol. 32 No. 1 (March 2022), 125-150

ISSN 2288-5404 (Print) / ISSN 2288-6818 (Online)
https://doi.org/10.14329/apjis.2022.32.1.125

A Study on the Effect of Anthropomorphism, Intelligence, and Autonomy of IPAs on Continuous Usage Intention: From the Perspective of Bi-Dimensional Value

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ABSTRACT

Technology companies launched their intelligent personal assistants (IPAs). IPAs not only provide individuals with a convenient way to interact with technology but also offer them the opportunity to interact with AI in a useful and meaningful form. Therefore, the global IPAs have experienced tremendous growth over the past decade. But maintaining continuous usage intention is still a massive challenge for developers and marketers and previous technology adoption models are not enough to explain continuous usage intention of IPAs. Thus, we adopted the bi-dimensional perspectives of utilitarian and hedonic value in this research model, and investigated how three characteristics of IPAs - anthropomorphism, autonomy, and intelligence - affect utilitarian value and hedonic value, which in turn continuous usage intentions. 227 data were collected from IPA users. The results showed that IPAs' continuous usage intention is significantly determined by both utilitarian and hedonic value, with the hedonic value being more prominent. In addition, the results showed that anthropomorphism and intelligence are the most important antecedents of utilitarian and hedonistic value. The results also illustrated that autonomy is a crucial predictor of utilitarian value rather than hedonistic value. Our work contributes to current research by widening the theoretical understanding of the effect of IPA characteristics on continuous usage intention through bi-dimensional values. Our paper also provides IPAs' developer and marketer guidelines for enhancing continuous usage intention.

Keywords: Anthropomorphism, Intelligence, Autonomy, Utilitarian Value, Hedonic Value, IPAs

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Ⅰ. Introduction

After Apple launched Siri in 2011, many major technology companies launched their intelligent personal assistants (IPAs) - Cortana, Alexa, and Google Assistant in the US; Bixby and NUGU in Korea; TmallGenie and Xiaoai Classmate in China. IPAs not only provide individuals with a convenient way to interact with technology but also offer them the opportunity to interact with AI in a useful and meaningful form (Guzman, 2019). Therefore, IPAs have experienced tremendous growth over the past decade, and market consultants also predicted that the global IPA market is projected to grow at a compound annual rate of 32.8% from 2016 to 2024, reaching a value of $7.9 billion (Transparency Market Research, 2016). Global Market Insight also revealed that the IPA markets are expected to grow at a CAGR of 34.9% by 2024, with global markets approaching $11 billion. From a consumer usage perspective, globe digital assistant users are projected to increase from 390 million to 1.8 billion between 2015 and 2021 (Knote et al., 2018). However, Choi and Kim (2016) indicated that although IPAs have received great attention in the market, the actual user level is lower than expected. According to the Voice Assistant Consumer Adoption Report 2018, the usage rate of IPA in different devices is all less than half, for example, 45.5% in smartphones and 24.3% in smart speakers, and Verto Analytics also indicated that 70% of users will not continue to use the IPAs after the first attempt (Connie Hwong, 2017). That is inconsistent with the expectations of market consultants (Hu et al., 2019). To explain this phenomenon, we need to figure out why people don't keep using IPAs and how people continue to use IPAs.

Continuous usage intention has been examined based on technology acceptance model (Davis, 1989) and theory of acceptance and use of technology (Venkatesh et al., 2003). However, the ease of use and usefulness in these theories are limited to explain continuous usage intention of IPA with learning ability and voice recognition (Bagozzi 2007; McLean and Osei-Frimpong, 2019). IPAs that consumers used are capable of multitasking (Nass and Brave, 2005; Strayer et al., 2017) and tailored tasks (Han and Yang, 2018). Consumers can use IPA very easily through voice commands. Thus, the ease of use as a primary predictor in technology acceptance model can be less explanatory (Moussawi, 2016). IPA consumers focus more on maximizing value than usefulness and ease of use (Lin et al., 2012; Kim et al., 2007). Thus, continuous usage Intention of IPAs can be better explained by value perception (Kim et al., 2007; Lin et al., 2012). To represent the value perception that affects consumers' behavioral intentions (Ryu et al., 2010), the bi-dimensional value of utilitarian and hedonic value (Babin et al., 1994; Bridges and Florsheim, 2008; Chandon et al., 2000; Eroglu et al., 2005) are frequently used. Bi-dimensional value perception is used in different areas, such like social media (Ashraf et al., 2019), mobile wallets (Lee et al., 2015), mobile apps (Kim et al., 2019), and IoT smart home (Kim et al., 2017).

Value perception can be influenced by IPA characteristics. The main characteristics of IPA are the intelligence to recognize, learn, and solve problems, the autonomy to handle tasks independently without human intervention, and the anthropomorphism to relieve loneliness and provide emotional stability through voice conversation. This study investigated that anthropomorphism, intelligence, and autonomy of IPAs can affect bi-dimensional value perception of utilitarian and hedonic value and further influence intention to continue using them. Identifying the influencing factors of continuous us-

age intention of IPA is very valuable for IPA developers or companies who can achieve high business performance by understanding the characteristics and value perception of IPA that consumers want and realizing them in their products and services.

The paper is organized as follows: Section 2 presents literature review, IPA characteristics, and value perception. Section 3 presents research model and hypothesis. Section 4 examines research method such as survey instrument development and data collection. Section 5 deals with data analysis such as measurement model analysis and structural model analysis. And this paper concludes with discussion, theoretical and managerial implications, and limitations of the study.

Ⅱ. Theoretical Consideration

2.1. Characteristics of IPAs

IPAs, also referred to as voice assistants, conversational agents, virtual assistants, personal assistants, and intelligent assistants, have been defined in similar terms (Cao et al., 2019). The literature review revealed that the definition of IPA has gradually been changed and IPA is primarily defined in terms of its functional characteristics and the way it interacts with users. In the terms of functional characteristics, IPA is defined as a hardware-based or software-based computer system with attributes of autonomy, sociality, responsiveness, and productivity (Wooldridge and Jennings, 1995). Furthermore, IPA is a personalized system that operates autonomously, is aware of its environment, anticipates the user's needs, learns and adapts to change, communicates with the user, finds necessary information, and provides output promptly (March et al., 2000; Mitchell et al., 1994; Russell and Norvig, 2003; Shoham, 1993; Steels and Brooks, 1995; Woolridge and Jennings, 1995). In the terms of how they interact with users, Myers et al. (2007) defined IPAs as software agents that can automate and facilitate many of the daily tasks for their users. Cao et al. (2019) defined IPA as an application that can respond to the user's requests, synchronically engage in humanoid interaction, even learn the users' behavior preferences and evolve. In more detail, Moussawi (2016) defined the IPAs as an autonomous personal system that provides essential information promptly through communication with the user by recognizing the user's environment, anticipating the user's needs, learning about changes, and adapting to them.

IPAs as agents quickly provide information to users through conversations by recognizing and adapting to a changing environment (Han and Yang, 2018; Moussawi, 2016; Santos et al., 2016). Previous studies have presented the main characteristics of these agents as anthropomorphism (Han, 2021; King and Ohya, 1996; Nass et al., 1994; Waytz et al., 2014). This is because anthropomorphism allows for a variety of easily identifiable behaviors and social interactions. However, these representations tend not to provide a quick assessment of the agent's abilities, especially during initial exposure to the agent. And anthropomorphic representation may be problematic because it can be inherently interpreted as having high levels of intelligence and autonomy (King and Ohya, 1996). Therefore, Moussawi and Koufaris (2019) presented the characteristics of agents as anthropomorphism and intelligence in a study on Personal Intelligent Agents. And King and Ohya (1996) represented the characteristics of agents as anthropomorphism, agency, and intelligence. This study set the characteristics of IPA as anthropomorphism, intelligence, and autonomy, which was

based on King and Ohya (1996), and considered autonomy instead of agency, because autonomy is more commonly used in the recent literature than agency (Gray et al., 2007; Hoffman and Novak, 2018; Hu et al., 2019; Waytz et al., 2014).

2.1.1. Anthropomorphism

Anthropomorphism is derived from the Greek words: Anthropos, i.e., human, and morphe, i.e., shape or form (etymonline.com and merriam-webster.com). Anthropomorphism is the act of attributing capacities that people think of as distinctly human to non-human agents (Waytz et al., 2014; Moussawi and Koufari, 2019). In other words, anthropomorphism is defined as the tendency to attribute human characteristics, motivations, intentions, or emotions to the actual or perceived behavior of non-human actors (Epley et al., 2007). Any object that exhibits human-like characteristics, such as emotions, cognitions, intentions, and experience may be anthropomorphized by an observer (Epley et al., 2007, Gray et al., 2007). In the IPA context, anthropomorphism is defined as the extent to which uses perceive the agent as human-like and can be measured by the ability to display human-like emotions such as joy, love, frustration, friendliness, care, and humour (Moussawi, 2016).

2.1.2. Intelligence

Intelligence has been defined in various domains. In AI field, it was defined as problem-solving, learning and improvement, and environment awareness abilities (Legg and Hutter, 2007). IPAs can help humans perform everyday tasks (Han and Yang, 2018; Santo et al., 2016). The efficiency and effectiveness of the IPA's work performance (Moussawi, 2016) is a crucial factor in identifying the intelligence of IPAs. In other words, an intelligent system can respond and act quickly to achieve the best outcome or the best-expected outcome (Moussawi, 2016). The intelligence of IPAs also includes the ability to process and generate natural language (Moussawi and Koufaris, 2019), which enables IPAs to successfully communicate with users via voice.

2.1.3. Autonomy

Autonomy refers to the ability of a system to perform tasks derived from humans without specific human intervention (Hoffmanh and Novak, 2018; Parasuraman et al., 2000). IPAs are a class of autonomous agents designed to assist human to perform everyday tasks according to the needs or preferences of their users (Han and Yang, 2018; Santos et al., 2016). The autonomy of IPAs enables IPAs to independently perform various tasks within a specific range specified by their users (Maes, 1995). Gray et al. (2007) pointed out that artificial autonomy not only leads individuals to infer the ability of IPAs to assist users to do something autonomously but also to enhance users' experience.

2.2. Bi-Dimensional Value: Utilitarian and Hedonic

Bi-dimensional value of utilitarian and hedonic value is often used to represent customer value (Babin et al., 1994; Bridges and Florsheim, 2008; Eroglu et al., 2005). Consumers' utilitarian and hedonic value has been wildly used to study consumers' intention in B2C e-commerce (Chiu et al., 2014), online shopping (Sakarya and Soyer, 2014), mobile data service environment (Kim and Han, 2011).

Utilitarian aspects of consumer behavior have of-

ten been defined as task-related, rational (Babin et al., 1994; Batra and Ahtola, 1991), convenient, and time-saving characteristics (Jarvenpaa and Todd, 1996; Teo, 2001). For example, Jones et al. (2006) emphasized that when consumers purchase products, they are concerned with achieving their goals in an efficient and timely manner while minimizing hassles. Moreover, utilitarian value is closely related to the effectiveness and efficiency that result from the use of a service (Venkatesh and Brown, 2001). From a utilitarian value perspective, the use of the service is understood as a means of accomplishing some task-related ends (Babin et al., 1994; Holbrook and Batra, 1987). In the field of IS, customers make rational and calculated assessments of the functional benefits and sacrifices of using IS (Hong and Tam, 2006; Kim et al., 2007), thus, utilitarian value is a crucial determinant of behavioral intention to adopt and use IS (Kim and Han, 2011). In the field of AI, McLean and Osei-Frimpong (2019) also confirmed this view as they pointed out that individuals are motivated by the utilitarian benefits when interacting with Artificial Intelligent In-Home Voice Assistants.

The definition of hedonic value exists in several domains and shares similar factors - its entertainment and emotional worth (Arnold and Reynolds, 2003; Babin et al., 1994; Wakefield and Baker, 1998), pleasure-oriented (Ryu et al., 2010), and primarily motivated by the desire for sensual pleasure, fantasy, and fun (Babin et al., 1994; Hirschman and Holbrook, 1982; Lageat et al., 2003). Hedonic value is more subjective and personal than utilitarian value and results from the fun derived rather than task completion (Holbrook and Batra, 1987). Research on IS has empirically shown that hedonic value is a key determinant that consumers perceive as important in the context of using IS (Turel et al., 2007; Venkatesh and Brown, 2001). In WeChat, for example, the key role of hedonic value in explaining intention to continue using has been elaborated (Zhang et al., 2017). And the hedonic-system acceptance model (van der Heijden, 2004) has also shown that satisfaction of entertainment motives leads to user acceptance in online games, social network services, and virtual reality (Lim and Park, 2016).

2.3. IPAs' Use-Related Literature

Prior studies on IPA have explored various dimensions, and more recent studies are beginning to focus attention on IPA use-related issues (Cao et al., 2019). The literature examining the adoption and use of IPAs is discussed extensively in the Human-Computer Interaction (HCI) (Weber and Ludwig, 2020). The Technology Acceptance Model (TAM) (Davis, 1989) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2012) have been used extensively in recent years to understand the adoption and use of new technology. Meta-analyses found that the perceived usefulness and perceived ease of use explain approximately 40% of the variance in an individual's behavioral intention to use a technology (Legris et al., 2003). Additional variables were later amalgamated into TAM (e.g., social norms in TAM2, enjoyment in TAM3). San-Martin et al. (2013) criticized TAM as being too simplistic. Lim (2018) also pointed out that the limitations of TAM can no longer adequately explain users' adoption with a high level of advanced technology such as IPAs (McLean and Osei-Frimpong, 2019). Therefore, Phaosathianphan and Leelasantitham (2019) examined the intention to use intelligent travel assistants through UTAUT theory with 8 antecedent factors including enjoyment and usefulness. The usage intention of IPAs has been debated in other subfields. Ki et al. (2020) pointed

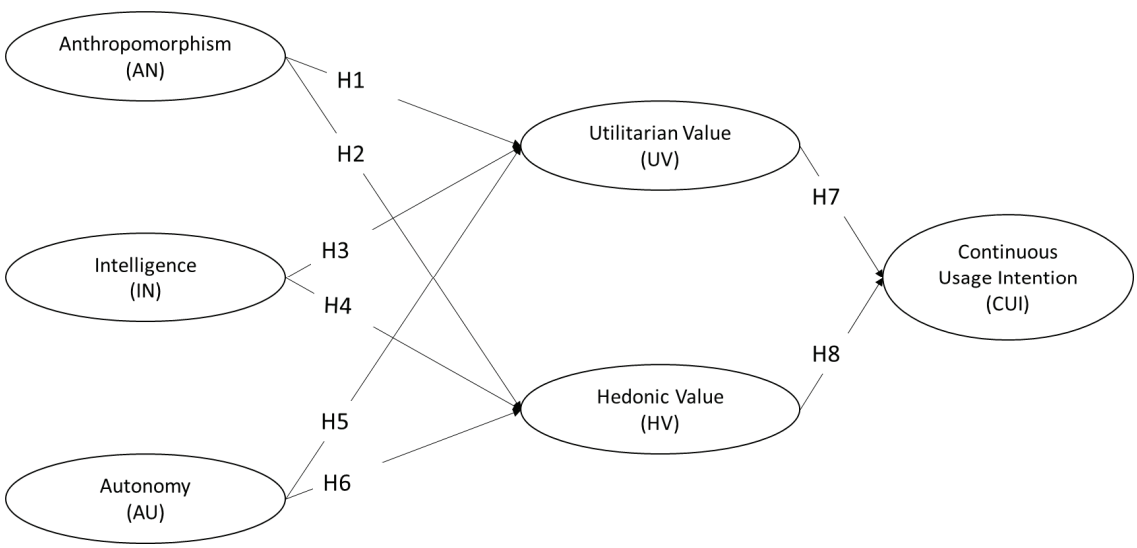
out that individuals are willing to adopt IPAs by establishing para-social relationships (PSRs) with the systems. Perceived value theory (Yang and Lee, 2019) and theory of planned behavior (Yang et al., 2017) are also used to examine users' intention towards IPAs. But, most of the prior studies on IPAs have been aimed at the user's adoption or usage intention, and the studies on the continuous usage intention of IPAs are limited.

Ⅲ. Conceptual Development

The first use of an information technology product or service can be a meaningful step in business or business operation. However, its ultimate success depends on continued use rather than initial use (Bhattacherjee, 2001; Crego and Schiffrin, 1995). Among first-time IPA users, 70% do not continue to use it (Connie Hwong, 2017). Therefore, we selected continuous usage intention of IPA as the dependent variable, instead of intention to use. Continuous usage Intention of IPAs can be better explained based on value perception rather than usefulness and ease of use (Kim et al., 2007; Lin et al., 2012). Therefore, we adopted value perception as influencing factors of continuous usage intention. We classified value perception as bi-dimensional value of utilitarian and hedonic value (Babin et al., 1994; Sharma et al., 2020). And, as factors affecting the value perception, IPA characteristics were set as anthropomorphism, intelligence, and autonomy, based on the study of King and Ohya (1996). Therefore, this paper suggests that characteristics of IPA affect users' bi-dimensional value perception and, through this, influence continuous usage intention of IPA. <Figure 1> shows research model and 8 hypotheses are presented in this section.

3.1. Anthropomorphism and Utilitarian Value

Marketers have been anthropomorphizing products and brands for many years (Ambroise and Valette-Florence, 2010; Kim and McGill, 2011). In



<Figure 1> Research Model

most cases, it is a well-balanced anthropomorphic phenomenon, namely, the persona effect, which promotes an agent's credibility, perceived usefulness, and entertainment value, and thus positively affects users' attitudes towards the system (Lester et al., 1997). Anthropomorphizing non-human entities improves people's ability to explain the non-human entities' actions and, accordingly, increases users' confidence in interacting with them (Luczakma et al., 2003).

Park and Moon (2003) found that the decision of whether a particular product is utilitarian or hedonistic is crucially based on consumers' subjective judgment of the product's value. Utilitarian value is defined as an overall assessment of functional benefits and sacrifices (Overby and Lee, 2006) and various functional domains have been included in the utilitarian value, such as assessment of convenience, time savings (Jarvenpaa and Todd, 1996; Teo, 2001), and efficient goal attainment (Babin et al., 1994). Utilitarian value is closely related to usefulness in the sense of achieving goals effectively and efficiently. Research in the field of interactive virtual agents and the anthropomorphism of Internet sites shows that the inclusion of anthropomorphic elements increases the perceived usefulness of an Internet site (Garnierg and Poncin, 2013; Hassanein and Head, 2007; Nan et al., 2006; Viot and Bressolles, 2012). Furthermore, according to Epley et al. (2007), anthropomorphism in companion robots can promote usefulness perceptions and improve user performance. Rietz et al. (2019) found that the anthropomorphic design of a chatbot has a significant positive impact on users' perceived usefulness. Schmitz et al. (2006) discussed that the usability of anthropomorphic representations not only enriches the user experiences but also has the potential to increase the efficiency of interactions and problem-solving abilities of the user. These authors also believe that the anthropomorphic appearance of a robot can create social links and social interaction, which also increase perceived usefulness (Burgoon et al., 2000). Therefore, we hypothesize that the higher the level of anthropomorphism, the higher the utilitarian value for consumers.

H1: Anthropomorphism of IPAs has a positive effect on utilitarian value.

3.2. Anthropomorphism and Hedonic Value

When users refer to IPAs as "she" or "he", they have already anthropomorphized IPAs (Pitardi and Marriott, 2021). Previous studies have shown that individuals anthropomorphize to compensate for their lack of social connection (Epley et al., 2008). The more human-like features are displayed, the more social presence is achieved (Chattaraman et al., 2019). For example, as one of the most important characteristics of IPAs, voice is a vigorous signal to induce anthropomorphism (Lee and Nass, 2004), and voice alone is sufficient for people to develop a deeper connection to technology (Han and Yang, 2018; Novak and Hoffman, 2019; Schweitzer et al., 2019). Once people feel comfortable in their conversations with an artificial personification, like conversations with other humans, they develop a relationship with the artificial assistant (Cerekovic et al., 2016).

Hedonic value is the emotional value of users' enjoyment, pleasure, entertainment, and fun through a product or service (Babin et al., 1994; Lageat et al., 2003). Heerink et al. (2008) demonstrated that a stronger sense of social presence leads to a stronger sense of enjoyment and that social presence might be the determining factor for enjoyment. In the context of IPAs, anthropomorphism as the trigger sche-

ma of social presence (Nass and Moon, 2000) should also be a determinant of hedonic value (Kim, 2017). The more anthropomorphic elements are strengthened in the system, the more positive interaction responses will be elicited from users, which increases reliability and intimacy (Nass and Brave, 2005; Nass and Moon, 2000). Once users anthropomorphize the object, they enter a relationship with it, which changes the emotional quality of the experience, making it more positive and pleasurable (Chandler and Schwarz, 2010; Wang et al., 2007). Therefore, we hypothesize that the higher the level of anthropomorphism, the higher the hedonic value for consumers.

H2: Anthropomorphism of IPAs has a positive effect on hedonic value.

3.3. Intelligence and Utilitarian Value

The intelligence of IPAs includes environment awareness and learning abilities, efficient and effective goal achievement, and natural language processing such as voice. And the most representative of these capabilities is the ability to communicate with users via voice (Alepis and Patsakis, 2017). Interacting with IPAs via voice means that users no longer need to type, read, and hold a device (Hoy, 2018), which enabled them to complete their multi-tasks when interacting with IPAs, so that little effort (sacrifices) was expended in achieving goals (benefits). Moreover, the ability to communicate through the voice of IPAs provides people more comfort in completing their tasks (McLean and Osei-Frimpong, 2019). Moreover, the intelligence of IPAs helps users to connect and manage many applications, devices, and services (Ponciano et al., 2015). Once IPAs are managed by users, all applications can be easily controlled (Kim, 2017).

According to Kamis et al. (2008), effort and cognitive load can be reduced when task complexity decreases, thus achieving the goal efficiently. The intelligent capacity of IPAs allows the system to convert and store what it knows and hears (Russell and Norvig 2003) and analyze users' behavior (Hwang and Yoon, 2017). Once users are provided with updating information (Hwang and Yoon, 2017) and customized service (Kim, 2017) in real-time, they believe that IPAs save time. For example, Hofmann et al. (2016) pointed out that the depth and breadth of stored information available, combined with the speed of technical response, facilitates a dialogue-style interaction which is important to the time-pressed consumers. Hu et al. (2021) also pointed out that workers with less free time are more likely to rely on IPAs compared to students. Therefore, we hypothesize that the higher the level of intelligence, the higher the utilitarian value for consumers.

H3: Intelligence of IPAs has a positive effect on utilitarian value.

3.4. Intelligence and Hedonic Value

Communication ability (Kim, 2017) as a certain intelligent capacity of IPAs (Russell and Norvig, 2003) enables IPAs to understand users' queries and ask follow-up questions. Thus, interacting with IPAs enable people to complete a task conveniently with little effort (Hoy, 2018; McLean and Osei-Frimpong, 2019). Joo (2016) indicated that both convenience and little effort can increase a person's enjoyment and sense of flow when playing a digital game. Moreover, Vorderer and Klimmt (2003) showed that interactivity is a key factor in the enjoyment process. Therefore, Interaction through natural language

processing ability with IPAs positively affects users' perceived enjoyment of using IPAs (Kim, 2017). Klimmt et al. (2007) reported that perceived effectiveness in video gaming significantly increases perceived enjoyment of the game.

General intelligence enables IPAs to transform and store what it knows and hears from experience, newly acquired information, and the user's behavior (Moussawi, 2016; Russell and Norvig, 2003). For example, when interacting with users, IPAs are able to formulate precise queries based on the user's specific context (March et al., 2000) and they are able to use and learn all information they receive from the user and their environment (Moussawi, 2016). This can reduce the burden on the users (King and Ohya, 1996) and provide a high level of reliability and convenience to the users (Wise et al., 2016). Cognitive experiences such as intelligence perception (Childers et al., 2001) influence emotional experiences in context (Lee, 2015). Furthermore, providing fluid information based on circumstances means that the user experiences pleasure (Kim, 2017). Following this logic, the intelligence of IPA embodied in the process of helping users achieve their goals can increase users' interest and lead them to derive more enjoyment from their user experience. Therefore, we hypothesize that the higher the level of intelligence, the higher the hedonic value for consumers.

H4: Intelligence of IPAs has a positive effect on hedonic value

3.5. Autonomy and Utilitarian Value

IPAs are expected to be able to function autonomously without continuous user intervention at every step. The agent can perform tasks on behalf of the user independently without the user's constant intervention (Moussawi, 2016). The high level of autonomy that enables IPAs to perform tasks independently, solve problems, and achieve the user's goal with less user interventions can lead to the positive conclusion that the IPAs are capable and competent (Hu et al., 2021). Moreover, autonomy not only enables the IPA to actively recommend plans based on user preferences, suggest schedules, and self-learn based on previous interactions, but also autonomously gather information and create optimal plans to better meet users' needs and preferences (Hu et al., 2021).

Kamis et al. (2008) pointed out that Decision Support Systems which reduce task complexity and user effort through autonomous features, increases perceived usefulness and perceived ease of use. Such enhanced autonomy can reduce users' information redundancy or overload, save users' unnecessary effort, and increase overall efficiency and effectiveness (Duan et al, 2019). Moussawi (2016) also pointed that autonomous IPA can positively affect the perceived usefulness of IPAs. Therefore, we hypothesize that the higher the level of autonomy, the higher the utilitarian value for consumers.

H5: Autonomy of IPAs has a positive effect on utilitarian value

3.6. Autonomy and Hedonic Value

The taxonomy of artificial autonomy can be divided according to how well IPAs perform various aspects of the tasks. Each task, no matter how simple or complex, can be divided into three primitives: sense, think, and act (Siegel, 2003). Hu et al. (2021) classified IPA autonomy as sensing, thinking, and acting autonomy. Sensing autonomy enables IPAs to constantly respond to users' commands, actively monitor user needs at all times, and detect abnormal

and sudden changes in conditions in the environment. This type of autonomy signals the IPA's obvious concern for its user, which would easily lead IPAs to be perceived as caring, friendly, and kind (Hu et al., 2021). Thinking autonomy mainly focuses on self-learning to make personalized decisions based on the user's preferences and habits (Santos et al., 2016), which can not only represent the intelligence of IPAs but also stimulate the user sense of being taken care of by IPAs (Huang and Rust, 2021). Acting autonomy enables users to employ IPAs to implement actions to perform tasks hand-free according to their needs (Han and Yang, 2018). When their expectations are implemented and fulfilled by IPAs, affective inferences naturally arise among users about the friendliness and kindness of IPAs (Hu et al., 2021).

Sensing, thinking, and acting autonomy can contribute to the user's affective perception such as friendliness, kindness, caring, and even closeness (Hu et al., 2021; Lee et al., 2020). And the autonomy of IPAs expressed in the process of helping users achieve their goals may increase users' interest and lead them to enjoy their user experience more (Hu et al., 2021). Therefore, we hypothesize that the higher the level of autonomy, the higher the hedonic value for consumers.

H6: Autonomy of IPAs has a positive effect on hedonic value.

3.7. Value Perception and Continuous Usage Intention

In consumption phenomena, bi-dimensional value of utilitarian and hedonic values are wildly adopted to understand consumers' evaluations of the consumption experience (Babin et al., 1994; Bridges and Florsheim, 2008; Chandon et al., 2000; Childers et al., 2001; Eroglu et al., 2005; Hirschman and Holbrook, 1982; Homer, 2008; Jones et al., 2006). Moreover, behavioral research in Internet consumption shows that both hedonism and utilitarianism are prevalent in an online environment (Hartman and Samra, 2008; Zhang et al., 2017). Therefore, both utilitarian value and hedonic value are described as key drivers to influence individuals' intention and have been extensively discussed in various domains by IS.

Ukpabi (2019) stated that utilitarian value is a key antecedent of continuous usage intention. Deng et al. (2010) proved that utilitarian value in a mobile app influences the user's continuous usage intention. Kim and Han (2011) also pointed out that utilitarian value in a mobile service data environment affects user's intention to use it. Meanwhile, Davis et al. (2013) found that hedonism influences user's behavioral intentions toward online games. Sharma et al. (2020) proved that hedonic value influences users' continuous usage intention toward online games. The key role of hedonic value in explaining intention to continue using was also elaborated in the study of Zhang et al. (2017) on WeChat study. Therefore, we hypothesize that the higher the utilitarian and hedonic value, the higher the continuous usage intention towards IPAs.

H7: Utilitarian value has a positive effect on IPAs' continuous usage intention.

H8: Hedonic value has a positive effect on the IPAs' continuous usage intention.

Ⅳ. Research Method

4.1. Survey Instrument Development

An online survey Wenjuanxing (https://www.

wjx.cn), a professional online questionnaire platform similar to Amazon Mechanical Turk (Zhang et al., 2016), was used to collect survey data. All items of the survey questionnaire were adapted from previous studies and adapted to the context of this study on IPAs. Measurement items consist of two sections: demographic questions and main questions. Demographic questions include gender, age, education, types of IPAs use, length of using IPAs, the purpose of using IPAs, and frequency of using IPAs.

The constructs of this research model consist of utilitarian value, hedonic value, anthropomorphism, intelligence, autonomy, and continuous usage intention, as shown in <Figure 1>. <Table 1> shows the six constructs, the measurement items, and references for each item. All items were measured on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree". Before distributing the

<Table 1> Measurement Items

Variable	Variable No.	Measurement	Reference
Utilitarian Value (UV)	UV 1	Getting information from IPAs is very simple for me.	Chen et al. (2017)
	UV 2	Completing tasks with IPAs makes my life easier	Mclean and Osei-Frimpong (2019)
	UV 3	Completing tasks with IPAs fits my schedule.	
	UV 4	The functions provided by IPAs is practical	Stock et al. (2015)
Hedonic Value (HV)	HV 1	The actual process of using IPAs is entertaining	Chen et al. (2017)
	HV 2	I have fun when using IPAs to complete tasks	Mclean and Osei-Frimpong (2019)
	HV 3	Using IPAs is interesting	
	HV 4	I am glad to use IPAs	Pebrianti (2016)
Anthropomorphism (AN)	AN 1	When I interact with IPAs, I feel there is a sense of human contact	Moussawi (2016)
	AN 2	The IPAs can convey sentiment at times, such as getting frustrated and upset or showing love and so on.	Moussawi and Koufaris (2019)
	AN 3	The IPAs is sociable than unsociable.	Kuosmanen (2020)
Intelligence (IN)	IN 1	The IPAs can complete tasks quickly.	Moussawi (2016) Moussawi and Koufaris (2019)
	IN 2	The IPAs can communicate with me in an understandable manner.	
	IN 3	The IPAs is aware of the physical world (eg. Its user) and the virtual world (eg. Other APPs)	
Autonomy (AU)	AU 1	IPAs can autonomously be aware do the state of its surroundings (eg. Recognize information from the environment or objects in the environment)	Hu et al. (2021)
	AU 2	IPAs can autonomously provide me choices of what to do (eg. Recommendations for actin plans for assigned matters)	
	AU 3	IPAs can independently implement, perform and complete the operation of the skill.	
Continuous Usage Intention (CUI)	CUI 1	I intend to use IPAs in the future.	Kim et al. (2019) Kim (2017) Maichum et al. (2016)
	CUI 2	I plan to use IPAs frequently.	
	CUI 3	I intend to use IPAs than other search engines.	
	CUI 4	I intend to increase my use of IPAs in my daily like in the future.	

questionnaire, a pre-test was conducted to ensure reliability and validity. Twenty-two pre-test participants with IPAs experience were asked to complete a questionnaire and provided with good comments, including rewording of the attention check question, removing overlapping meanings, and invalid questions. According to the comments, anthropomorphism and intelligence were revised, and refined questions were used in the final survey.

4.2. Data Collection

The survey was conducted for 25 days, from 8th April 2021 to 3rd May 2021. Data collection was conducted over Wenjuanxing that is used by more than 30,000 well-known companies and universities. It is regarded as a trustworthy online survey platform (Hu et al., 2021). The data were collected from South Korea and China. All respondents had relevant experience in using IPAs. In the questionnaire survey, all respondents were informed about their anonymity, rights, the purposes of the study. A screening question was also used to ensure that all the responders had experience with IPA. Respondents who did not meet the screening criteria or whose questionnaire is incomplete were dropped from 251 responses and 227 complete and valid samples remained.

<Table 2> shows that 53% of respondents were female and 47% were male. The majority were aged between 31 and 40 years (37%) and between 41 and 50 years (40%). More than half (59%) of respondents have a Bachelor degree or Diploma certificate. 49% of respondents used Apple Siri, then Google Assistant, Samsung Bixby, and others respectively. 42% of respondents had at least 2 years of experience with IPA. Most purposes of using IPAs are entertainment and information requests, 37% and 31% respectively. 32% of participants used IPA 3 to 5 times per month.

Ⅴ. Data Analysis

In this paper, partial least squares structural equation modeling (PLS-SEM) analysis was used. First, PLS-SEM has become a popular tool for analyzing the relationships between different latent variables (Sarstedt and Cheah, 2019). Moreover, PLS-SEM requires minimal criteria for sample size, measurement scales, and residual distributions (Chin et al., 2003).

<Table 2> Demographics of Respondents

Items	Category	Frequency	Percentage
Gender	Male	107	47.14%
	Female	120	52.86%
Age	20~30	34	14.98%
	31~40	85	37.44%
	41~50	92	40.53%
	50 & Over	16	7.05%
Education	Secondary School	5	2.20%
	Bachelor & Diploma	133	58.59%
	Master	65	28.63%
	Doctor	24	10.57%
Types of IPAs	Apple Siri	112	49.34%
	Samsung Bixby	22	9.69%
	Google Assistant	77	33.92%
	Others	16	7.05%
Length of Use	Under 6 Months	57	25.11%
	6~12 Months	42	18.50%
	Over 1 Year	33	14.54%
	Over 2 Years	95	41.85%
Purpose of Use	Issue Command	61	26.78%
	Entertainment	83	36.56%
	Information Request	70	30.84%
	Curiosity	13	5.73%
Frequency of Use (Month)	1~2 Times	63	27.75%
	3~5 Times	72	31.72%
	6~10 Times	32	14.10%
	Over 10 Times	60	26.43%

Finally, PLS-SEM has the algorism for simultaneous automatic analysis of multiple mediation effects in one model (Ringle et al., 2015). Therefore, Smart-PLS 2.0 was used for the analysis of the measurement and structural model.

5.1. Measurement Model Analysis

To meet the threshold criteria of internal consistency (Fornell and Larcker, 1981), the component reliability (CR) and Cronbach's alpha for each construct should be above 0.7 and 0.6, respectively (Nunnally, 1987). The proposed model includes 21 items that are describing six latent constructs. <Table 3> shows that CR and Cronbach's alpha for each construct were greater than 0.8, indicating acceptable reliability of measurement constructs. In convergent validity, each average variance extracted (AVE) for all constructs was greater than the suggested cut-off value of 0.5 (Fornell and Larcker 1981), as shown in <Table 3>. Confirmatory factor analysis (CFA) was conducted for the measurement model (Klinek, 2011). The loading values of measurement items were all above 0.7 (Hu et al., 2021), which confirmed the concentration validity of the measurement items, and no cross-loading occurred. Moreover, T-values of the loading values were all over the threshold of 1.96 (Fornell and Larker, 1981).

For discriminant validity, the square root of the AVE of each construct should be higher than the corresponding construct correlation (Fornell and Larcker, 1981). <Table 4> showed that the square

<Table 3> Reliability and Convergent

Construct	Items	R Square	Cronbach's Alpha	Composite Reliability	AVE
Anthropomorphism (AN)	AN 1 AN 2 AN 3		0.902	0.938	0.835
Intelligence (IN)	IN 1 IN 2 IN 3		0.806	0.885	0.719
Autonomy (AU)	AU 1 AU 2 AU 3		0.805	0.885	0.721
Utilitarian Value (UV)	UV 1 UV 2 UV 3 UV 4	0.148	0.880	0.918	0.736
Hedonic Value (HV)	HV 1 HV 2 HV 3 HV 4	0.294	0.871	0.911	0.720
Continuous Usage Intention (CUI)	CUI 1 CUI 2 CUI 3 CUI 4	0.296	0.910	0.937	0.787

<Table 4> Discriminant Validity

	Anthropomorphism (AN)	Autonomy (AU)	Hedonic Value (HV)	Intelligence (IN)	Continuous Usage Intention (CUI)	Utilitarian Value (UV)
Anthropomorphism (AN)	**0.914**					
Autonomy (AU)	0.339	**0.849**				
Hedonic Value (HV)	0.505	0.268	**0.849**			
Intelligence (IN)	0.451	0.480	0.404	**0.848**		
Continuous Usage Intention (CUI)	0.565	0.430	0.481	0.577	**0.887**	
Utilitarian Value (UV)	0.290	0.299	0.172	0.316	0.334	**0.858**

Note: The numbers indicate the correlation values between the constructs, and the bold diagonal values indicate the square root of the AVE.

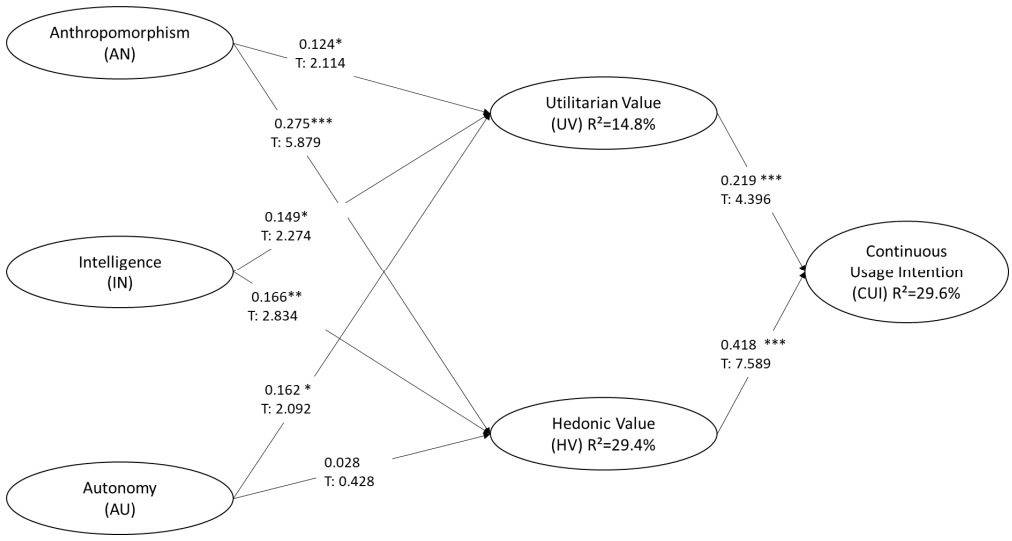
root of the AVE of each construct (0.848~0.914) was greater than the correlation values (0.577~0.172). Therefore, the desired discriminant validity was assessed (Fornell and Larcker, 1981).

Since this paper used the survey method in which the independent variable and the dependent variable were measured by the same measurement tool and response source, we performed Harman's single-factor test (Podsakoff et al., 2003) to check common method bias (CMB). In Harman's single-factor approach, all items measuring constructs are loaded into exploratory factor analysis (EFA) and run with an unrotated solution. If the variance of one dominant factor is more than 50% then it poses a threat of CMB. As a result of analyzing EFA with the data used in this study, the single dominant factor accounted for only 30 percent of the overall variance. Thus, the CBM threat was found not to be serious.

5.2. Structural Model Analysis

<Figure 2> shows the result evaluated by the PLS-SEM analysis. The explanatory power of the path model is represented by the value of R^2 (Chin and Gopal, 1995). As shown in <Table 3>, R^2 for utilitarian value (14.8%), hedonic value (29.4%), and continuous usage intention (29.6%) exceeded the explanatory power of 10% suggested by Falk and Miller (1992). Goodness-of-fit (GoF) test recommended by Wetzels et al. (2009) was assessed using the geometric mean of communality and R^2 means. GoF was 0.43 which is greater than 0.36 suggested by Wetzels et al. (2009), so the model fit of the structural model was good.

To verify the significance of path coefficients, the T-value of the path coefficient was calculated by bootstrap analysis (see <Table 5>). The T-value of the path coefficients showed that both anthropomorphism and intelligence had positive effects on utilitarian value and hedonic value, so H1, H2, H3, and H4 were all supported. Moreover, the utilitarian value was influenced by autonomy, but not hedonic value, so H5 was supported and the alternative hypothesis of H6 was not supported. Finally, utilitarian value and hedonic value had a positive effect on continuous usage intention, so H7, H8 was supported.



*P<0.05, **P<0.01, ***P<0.001

<Figure 2> Research Analysis Results

<Table 5> Path Coefficients

Hypotheses	Relationship	Path Coefficients	T-Statistics	Hypotheses Supported (Y/N)
H1	Anthropomorphism (An)->Utilitarian Value (Uv)	B: 0.124	2.114	Y
H2	Anthropomorphism (An)->Hedonic Value (Hv)	B: 0.275	5.879	Y
H3	Intelligence (In)->Utilitarian Value (Uv)	B: 0.149	2.274	Y
H4	Intelligence (In)->Hedonic Value (Hv)	B: 0.166	2.834	Y
H5	Autonomy (Au)->Utilitarian Value (Uv)	B: 0.162	2.092	Y
H6	Autonomy (Au)->Hedonic Value (Hv)	B: 0.028	0.428	N
H7	Utilitarian Value (Uv)->Continuous Usage Intention (Cui)	B: 0.219	4.936	Y
H8	Hedonic Value (Hv)->Continuous Usage Intention (Cui)	B: 0.418	7.598	Y

Ⅵ. Conclusion

6.1. Discussion of Results

IPAs have experienced tremendous technological growth over the past decade and have received great attention from the market. However, many of the first-time users of IPAs are not continuing to use them. To find out the reason, this paper investigated whether the characteristics of IPA, such as anthropomorphism, intelligence, and autonomy, affect the bi-dimensional value of utilitarian and hedonic value and, through them, influence the continuous usage intention of IPA. The discussion of the research results is as follows.

First, the results revealed that anthropomorphism is a key influencer of both utilitarian and hedonic value (H1, H2), confirming previous research find-

ings (Kim, 2017). Although the anthropomorphism of IPAs can positively influence both utilitarian and hedonic value, the effect of anthropomorphism on hedonic value is much stronger compared to utilitarian value. This is consistent with the research of Moussawi (2016), the more human-like the IPA is, the more fun the interaction is. This means that the anthropomorphism of IPAs is more likely to help users achieve happiness than the utility. This might be because anthropomorphism can help IPAs establish some relationship with users, which changes the emotional quality of the experience making it more positive and pleasurable (Chandler and Schwarz, 2010; Wang et al., 2007). In addition, users may develop a certain level of closeness and intimacy with IPAs when interacting in a human-like manner (Louie et al., 2014; Sproull et al., 1996). This experience can directly affect the user's hedonic value (emotional worth) rather than utilitarian value (task-related and rational worth) (Arnold and Reynolds, 2003; Babin et al., 1994; Batra and Ahtola, 1991; Wakefield and Baker, 1998).

Second, the findings also showed that intelligence has positive effects on both utilitarian and hedonic values (H3, H4). The effect of intelligence on hedonic value are slightly higher than that of utilitarian value. This may be because the use of IPAs is limited to basic tasks (Pitardi and Marriott, 2021). For example, the most used skills of IPAs are general questions, weather, and alarm timers (Activate, 2018) that do not require a high level of intelligence. Due to these basic attributes of the tasks that IPA users process, so far, IPA intelligence seems to have a greater effect on hedonic value than utilitarian value. The higher effects of intelligence on hedonic value may be because intelligence enables IPAs to communicate with users in a more natural way of speaking, which can result in a higher level of involvement with IPAs (Guzman, 2019; Ki et al., 2020). This type of involvement helps users achieve certain emotional states such as enjoyment, pleasure, and so on. This confirms Kim (2017)'s research that communication skills can positively influence perceived enjoyment (hedonic value).

Third, the findings also showed that autonomy has a positive impact on utilitarian value (H5). A previous study indicated that autonomy could affect the competence perception of IPAs (Hu et al., 2021), which was also strongly confirmed in our study. IPAs not only recognize various perceptual data and activate actions on other applications and devices to autonomously perform user-assigned tasks (Santos et al., 2016) but also reduce special human interventions as well. All of this brings convenience, efficiency, and effectiveness to users, so autonomy has a strong impact on utilitarian value. However, the impact of autonomy on hedonic value was found to be insignificant in our study. To some extent, the autonomy of IPAs entails uncomfortable experiences (e.g., feel annoying) to users (Weber and Ludwig, 2020). Furthermore, the autonomy of IPAs leads IPAs to perform tasks in a hidden way, resulting in a loss of the user's sense of control over the specific execution process (Hu et al., 2019). Losing control may also affect users' affective state towards IPAs. Thus, autonomy brings about utilitarian value, not hedonic value.

Finally, the result confirms that both utilitarian and hedonic values positively influence continuous usage intention toward IPAs (H7, H8). The most interesting result is that hedonic value influences continuous usage intention much more than utilitarian value. With the current technical status of IPAs, it might be easier for users to obtain hedonic value than utilitarian value. When users interact with IPAs, the external interfaces such as displaying hu-

man-like features, recognizing the user utterances correctly, and asking appropriate follow-up questions can directly result in obtaining hedonic value more easily than utilitarian value. Therefore, IPAs tend to be viewed as entertainment tools compared to productivity tools. With the continuous development of technology, if IPAs are used wildly to help users manage many applications, devices, and services in daily lives (Ponciano et al., 2015) and can solve complex problems effectively, users could obtain higher utilitarian value.

6.2. Theoretical and Managerial Implication

The theoretical and managerial implications of this study are as follows. Our study makes theoretical contributions to current literature. First, this paper developed and tested the model that comprehensively examines the role of both bi-dimensions values (hedonic and utilitarian value) and IPAs characteristics (anthropomorphism, intelligence, autonomy) in the continuous usage intention towards IPAs. Second, in line with previous research (Martin et al., 2015; Venkatesh et al., 2012), our study showed hedonic value has a greater impact on continuous usage intention compared to utilitarian value. This study indicated the importance of users' hedonic value on continuous usage intention towards IPAs. Third, limited research has been conducted on the effect of intelligence on hedonic value, but the present work investigated the relationship between intelligence and hedonic value, filling a previously unanswered gap in the literature. IPAs with high intelligence can communicate fluently with individuals and the fluid sense can arouse a sense of flow in users, which is an important antecedent to hedonic value. Forth, the results also illustrate that anthropomorphism is a key factor that influences both hedonic and utilitarian values. This is in line with previous studies that human-like characteristics play a significant role for IPAs' use (Wagner et al., 2019). This study showed that anthropomorphism had a much greater effect on hedonic value than on utilitarian value. Fifth, our paper has shown that autonomy is a controversial characteristic of IPAs. The effect of autonomy on utilitarian value was significant, but not on hedonic value. However, it is not clear whether these results are due to the immaturity of technological development or concerns about the loss of human control. Therefore, more research is needed on the effect of autonomy.

These findings provide managerial implications for the developers and marketers. First, the results of our study show that people want to use IPAs for both hedonic and utilitarian purposes. When users interact with IPAs, they expect that IPAs will help them to complete a task efficiently in the ideal time frame and that they will experience a certain affective state such as pleasure, entertainment, joy, and others. Moreover, the results have shown that hedonic value promotes continuous usage intention more than utilitarian value. Thus, developers who want to further improve continuous usage intention should continue to enhance the enjoyment, pleasure, and entertainment of IPAs. However, based on the original and final purpose of the development of IPAs, continuously improving the functional and instrumental value of the system is still a key factor for developers, which has also been shown in our research. Second, according to the results, anthropomorphism, intelligence, and autonomy all have some influence on the utilitarian dimension. Continuous development of these traits is crucial foci for developers. Anthropomorphism of IPAs improves the efficiency of interaction between the user and IPAs, thereby reducing users' cognitive burden. Intelligence enables

IPAs to process high-quality output within an ideal time frame, thereby improving user efficiency. Autonomy allows IPAs to complete tasks their own without user intervention and helps users complete tasks more easily, reducing their cognitive load. Therefore, enhancing and improving the anthropomorphism, intelligence, and autonomy of IPAs is crucial for achieving utilitarian value. Developers who want to expand the market through the domains of utilitarianism should always consider anthropomorphism, intelligence, and autonomy of IPAs. Third, the study also shows that not all three characteristics affect hedonic value for developers. Only anthropomorphism and intelligence play a role in hedonic domains. As the most important feature of IPAs, anthropomorphism plays a vital role in ensuring that users receive hedonic value when interacting with IPAs. Therefore, developers who want to increase their market share by enhancing the hedonic value of users should focus on improving the human-like features of IPAs. Developers should also be aware that the intelligence of IPAs is not only an important factor in achieving utilitarian value but also an important factor in achieving hedonic value. Therefore, further strengthening the intelligence of IPAs is an important factor for further expansion of the market. The effect of autonomy on hedonic value was not significant. Perhaps this is because the technological advances have not yet been made enough for users to trust and rely on IPAs. For example, the autonomous malfunction of the IPA causes the IPA to suddenly laugh out loud, surprising or offending the user. Improving the autonomy of IPAs to lower the negative emotions of users can be a key factor in achieving the hedonic value. Therefore, developers need to strive for sufficient technological advancement.

6.3. Limitations and Suggestions for Future Research

There are still limitations in our research. First, our study focuses on analysing three characteristics (anthropomorphism, intelligence, and autonomy) of IPAs; future research may explore other characteristics of IPAs such as personalization. Second, our research mainly focuses on the positive effects of continuous usage intention, but the negative effects are also a very important area. Future research can consider the role of the negative impact of continuous usage intention, such as perceived risks, perceived uncertainty, and others. Third, to reduce geographical limitations, the research was conducted in South Korea and China. As literature continues to discuss the importance of various factors in different cultural contexts, further research can examine different cultural contexts. Finally, in this study, the effect of autonomy on the hedonic value was not significant. However, this reason could not be presented convincingly. Therefore, further research on this is needed.

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Submitted: August 30, 2021; 1st Revision: January 17, 2022; Accepted: February 14, 2022