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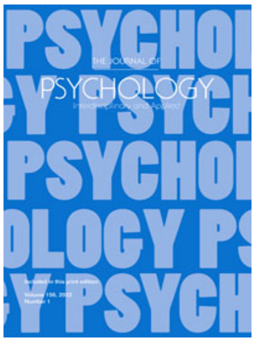

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Who Likes Artificial Intelligence? Personality Predictors of Attitudes toward Artificial Intelligence

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ABSTRACT

We examined how individuals' personality relates to various attitudes toward artificial intelligence (AI). Attitudes were organized into two dimensions of affective components (positive and negative emotions) and two dimensions of cognitive components (sociality and functionality). For personality, we focused on the Big Five personality traits (extraversion, agreeableness, conscientiousness, neuroticism, openness) and personal innovativeness in information technology. Based on a survey of 1,530 South Korean adults, we found that extraversion was related to negative emotions and low functionality. Agreeableness was associated with both positive and negative emotions, and it was positively associated with sociality and functionality. Conscientiousness was negatively related to negative emotions, and it was associated with high functionality, but also with low sociality. Neuroticism was related to negative emotions, but also to high sociality. Openness was positively linked to functionality, but did not predict other attitudes when other proximal predictors were included (e.g. prior use, personal innovativeness). Personal innovativeness in information technology consistently showed positive attitudes toward AI across all four dimensions. These findings provide mixed support for our hypotheses, and we discuss specific implications for future research and practice.

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Artificial intelligence; Big Five personality traits; personal innovativeness in information technology; attitudes

In this digital era, the use of artificial intelligence (AI) is prevalent and ever expanding in most life domains. AI broadly refers to the science of making machines do things in ways that would be done by humans, mimicking a diverse array of human capabilities (Kaplan & Haenlein, 2019; McCarthy et al., 2006). Science fiction movies and novels depict AI-enabled robots in both positive (e.g. friend) and negative (e.g. villain) lights and everywhere in-between; public opinions about AI also seem to vary widely from one extreme to the other (Cave & Dihal, 2019; Zhang & Dafoe, 2019). At the individual level, people tend to display different levels of favor or disfavor toward AI (e.g. Gaudiello et al., 2016; Shank et al., 2019; Waytz et al., 2010). Such expressions of favor and disfavor are based on one's evaluations of (or *attitudes* toward) the entity, which may be further broken down to affective, cognitive, and behavioral components – how one *feels* and *thinks* about it, and what one *intends to do* with it (Eagly & Chaiken, 2007). Research suggests that individuals' attitudes toward technology are strong predictors of actual usage and acceptance (Marangunić & Granić, 2015; Venkatesh

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& Davis, 2000), and therefore, it is important to understand how individuals differ in these attitudes and what factors can account for such differences.

In the current article, we focus on personality traits as a potential predictor of AI attitudes. Psychological research suggests that personality offers an effective framework for understanding why and how one thinks, feels, and behave in a certain way across different situations (Kenrick & Funder, 1988; Moskowitz, 1994), and that it serves as a systematic lens through which individuals view their surroundings as well as people, objects, and events in them (Moskowitz, 1994; Porter et al., 2017). As such, when faced with AI technology, one's general predisposition toward various cues/characteristics in the environment, people, and objects (e.g. novelty, complexity, functionality, sociality) will likely affect his/her attitudes toward AI. Personality traits are fundamental determinants of attitudes as they reflect variations in sensitivity to certain stimuli (Gray, 1973). Personality traits represent relative strength of positive and negative sensitivities toward the stimuli (Gray, 1973), and motivational sensitivity to and salience of a certain stimuli differ depending on personality traits. For example, those scoring high on openness react to novel agents and experiences positively, and they are motivated to appreciate the experiences (DeYoung et al., 2007; Saef et al., 2019). On the other hand, those high in neuroticism are sensitive toward negative and stressful events and appraise identical events more negatively than those low in neuroticism (Bolger & Zuckerman, 1995). AI is novel stimuli that elicits social, functional and emotional aspects (Gaudiello et al., 2016; Shank et al., 2019; Waytz et al., 2010), and personality traits would partly determine the extent to which people elicit certain attitudes toward AI. Empirical studies in human-computer interaction have also suggested that people's personality characteristics have direct influences on their attitudes toward autonomous technology (Stein et al., 2019) and interaction with robots (Santamaria & Nathan-Roberts, 2017).

Building on these previous findings, we take a more comprehensive and nuanced look at the links between personality and AI attitudes by considering the multifaceted nature of AI attitudes and explore how distinct aspects of attitudes may be uniquely predicted by different personality traits. Using the Five-Factor Model of personality (Digman, 1990; Goldberg, 1990; McCrae & Costa, 1997), we investigate the predictive effects of the following five personality traits on AI attitudes: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience (in short, openness). Scholars in the domain of the human-computer interaction also have used the Big Five traits, but often only a few of the five traits such as Extraversion have been selected for inclusion in examining a user's attitudes (for a review, see Santamaria & Nathan-Roberts, 2017). Only half of research on personality and human-computer interaction measured *humans*' personality, and 30% of them focused solely on extraversion and 25% of them used various measures of personality other than the Big Five traits (Santamaria & Nathan-Roberts, 2017). Due to the use of different personality measures and selective use of the Big Five traits, studies on the roles of personality in the human-computer interaction have yielded inconsistent findings (Santamaria & Nathan-Roberts, 2017). To resolve the inconsistencies, scholars recommend using the Five-Factor model as a "comprehensive, consistent, and valid framework" (Santamaria & Nathan-Roberts, 2017), which is validated across cultures and measures (Digman, 1990; Goldberg, 1990; McCrae & Costa, 1997).

As a broad concept, AI could be categorized based on the development stages (e.g. strong AI, weak AI) or specific features such as humanization (e.g. humanoid robots). In this study, we view AI as an abstract entity and focus on individuals' attitudes toward AI in general. Research to date has focused on personality traits and their relations to particular types of AI products or service such as humanoid robots (Woods et al., 2005) and autonomous robots (Gnambs & Appel, 2019), but relatively less is known about how people generally think and feel about AI technology as a whole. Past research was largely limited to studying personality's effects on behavioral aspects of attitudes such as intention to use (Barnett et al., 2015; Devaraj et al., 2008), whereas its effects on other (e.g. emotional and cognitive) aspects of attitudes toward AI have been rarely examined in a systematic manner.

In light of these considerations, our main goal in this study is to explore how personality affects diverse aspects of AI attitudes. Along with the Big Five traits, we also examine the role of personal innovativeness in information technology (PIIT, Agarwal & Prasad, 1998), which refers to "the willingness of an individual to try out any new information technology" (Agarwal & Prasad, 1998, p. 206). PIIT is a more domain-specific personality characteristic that is known to predict technology-related attitudes. To cover a wide range of attitudinal constructs, we not only consider one's behavioral intention to use AI, but also other variables that reflect affective and cognitive components of the AI attitudes such as positive and negative emotions, needs satisfaction, and warmth/competence perceptions. Additionally, as elaborated below, we also investigate how age interacts with some personality traits (openness and neuroticism) in predicting AI attitudes as suggested in the literature (Broadbent et al., 2009; Correa et al., 2010).

Attitudes toward AI

As a multidimensional construct, one's attitude(s) toward an object requires the examination of diverse aspects such as affective, cognitive, and behavioral components (Breckler, 1984). The three main components of attitudes are inter-correlated, yet uniquely contribute to a general attitude toward an object (Breckler, 1984). Possible attitudes toward a particular entity involve a positive or negative evaluation of the entity (Eagly & Chaiken, 2007). Attitudes toward AI include emotional, cognitive, and behavioral evaluations and these attitudes are constructed based on current information or representations of AI, which are partly affected by dispositions. Thus, we chose several attitudinal constructs that cover the affective, cognitive, and behavioral attitudes toward AI.

Affective evaluation refers to positive or negative emotions a person has toward an object (Breckler, 1984). Affective evaluation includes generalized mood states such as positive and negative affect and distinct emotions (e.g. fear, joy) (Ajzen & Fishbein, 2000). Formed through past experiences that constitute a mental residue (Breckler, 1984; Eagly & Chaiken, 2007), affective evaluation is constructed through both cognitive and non-cognitive processes (Breckler, 1984). Affective attitude (negative ones in particular) toward a new agent or technology can powerfully shape initial impressions about it, which often comes at a cost. For example, individual and sociological fear formed through media can be an obstacle to learn and accept AI (Liang & Lee, 2017). In fact, people commonly experience negative emotions such as threat and fear, and interacting with an autonomous agent increases threat and decreases acceptance of and further interaction with AI (Liang & Lee, 2017). On the other hand, people can also experience positive emotions such as joy and pleasure in using and interacting with AI (Oh et al., 2018; Shank et al., 2019). The perceived novelty and usefulness of AI brings amazement and joy (Oh et al., 2018; Shank et al., 2019). Positive experiences with AI subsequently shape positive attitudes toward AI (Oh et al., 2018). As personality plays a critical role in people's emotional experiences (Watson & Clark, 1992), investigating dispositional tendencies to feel negative and positive emotions toward AI would be a meaningful step toward understanding the root of individual differences in AI attitudes.

Along with the affective component of AI attitudes, we now turn to several constructs that are more in cognitive in nature. First, the fundamental needs for autonomy, competence, and relatedness (Deci & Ryan, 2000) in the context of using AI are worth exploring in this content domain. According to Self-Determination theory (Deci & Ryan, 2000), individuals' well-being is enhanced when their needs for autonomy, competence, and relatedness are fulfilled. Scholars have suggested that Self-Determination Theory may be useful for understanding how individuals form attitudes toward the use of AI (Cascio & Montealegre, 2016), but empirical research on this topic has been scarce. In addition to the need satisfaction constructs, we also consider two major dimensions of social cognition (or perception): warmth and competence (Fiske et al., 2007). When encountering an individual or a group, one primarily evaluates the entity based on warmth and competence dimensions (Fiske et al., 2007). Warmth includes relational and ethical characteristics such as friendliness and integrity, whereas competence includes characteristics that are related to ability and efficiency (Fiske et al., 2007). The ultimate evaluation of a social actor is influenced by the social perceptions and stereotypes toward the object (Fiske et al., 2002), dispositional factors influence the social information processes and relationship initiation with a social agent (Porter et al., 2017). People judge AI by personifying them as a social agent (Waytz et al., 2010), and evaluate the interaction with the AI based on their interaction with humans (Kim et al., 2019; Piçarra & Giger, 2018). The social perception dimensions in which individuals perceive others and external groups may also apply to the evaluative attitudes toward AI.

Lastly, we examine the behavioral intention to use AI. According to Ajzen's (1991) Theory of Planned Behavior, one of best predictors of a certain behavior is the person's intention to exhibit the behavior. The theory suggests that intentions can be predicted by behavioral, normative, and control beliefs about the specific behavior (Ajzen & Fishbein, 2000). Intentions are described as indications of how hard individuals are willing to try and plan to exert the behavior (Ajzen & Fishbein, 2000). Based on the definition, in the current article, we define behavioral intention to use AI as how much an individual is willing to use and try service and products using AI. Personality constructs such as the Big Five traits had shown to have a significant impact on behavioral intention to use (Devaraj et al., 2008; Santamaria & Nathan-Roberts, 2017), and one study found that the Big Five traits accounted for the behaviors of using information system such as the Internet more significantly than did cognitive styles (McElroy et al., 2007).

Big Five Personality Traits and AI Attitudes

In this section, we present some broad hypotheses and research questions regarding each personality trait and its general relation to AI attitudes. Although extraversion and neuroticism have been widely used in human-computer interaction (e.g. Hamburger & Ben-Artzi, 2000; Rice & Markey, 2009), the effects of extraversion on new technology or humanoid robots have been found inconsistent (e.g. Barnett et al., 2015; Landers & Lounsbury, 2006). Agreeableness and conscientiousness also have shown variant effects depending on types of attitudes (Devaraj et al., 2008; McElroy et al., 2007; Svendsen et al., 2013). Thus, we specified hypotheses regarding openness and neuroticism, while posing open-ended research questions about the other three traits (extraversion, agreeableness, and conscientiousness) without a directional hypothesis.

People who are high on openness tend to engage in and seek out new information and experiences (DeYoung et al., 2007), and as such, they are more likely to use and accept new technology (McElroy et al., 2007; Svendsen et al., 2013). Openness positively relates not only to new technology but to first impression toward unfamiliar people (Saef et al., 2019). Those with high openness tend to perceive an unfamiliar group of people based on individuating information than category-based information, thus they perceive less dissimilarity and show more trust toward them (Saef et al., 2019). Given that individuals with high openness are motivated to explore novel activities and are more trusting toward unfamiliar agents, we expect they would show more favorable attitudes toward AI compared with those with low openness.

Hypothesis 1: Openness is positively related to positive attitudes toward AI.

Neuroticism has been described as the primary source of negative emotion, and neurotic individuals are predisposed to a general sensitivity to threat and punishment (DeYoung et al., 2007). Because individuals with high neuroticism are motivated to withdraw and inhibit behaviors when faced with stimuli (DeYoung et al., 2007), they tend to resist new changes and are less receptive to them (Barnett et al., 2015). They feel anxious about new way of computer-mediated communication (Rice & Markey, 2009). Threat is one of the most common experiences that people face in communicating with AI (Liang & Lee, 2017; Shank et al., 2019; Stein et al., 2019), and those with high neuroticism tend to be sensitive to threat and stressed about new experiences may exhibit more negative attitudes toward AI than less neurotic individuals.

Hypothesis 2: Neuroticism is negatively related to positive attitudes toward AI.

Individuals with high extraversion tend to place a high value on interpersonal relationships, which they perceive to be rewarding and are predisposed to experience positive emotions (Costa & McCrae, 1992; Watson & Clark, 1992). Due to the positive nature, their emotional reactions toward social robots and new technology are generally positive (Devaraj et al., 2008; Rice & Markey, 2009). Reflecting its nature, female undergraduate students with high extraversion felt less anxious after communicating computer-mediated communication (Rice & Markey, 2009). Also, a studying using 959 American participants ranged from 18 to 84 found that extraversion was positively related to technology-mediated communication frequency (Correa et al., 2010). At the same time, a study based on American college students suggested that extraverts tend to prefer face-to-face interactions rather than technology-mediated interactions and tend to spend less time on social interactions involving computers (Landers &

Lounsbury, 2006). Some studies of college students indeed found that extraversion was negatively related to actual use of new technology (Barnett et al., 2015), and that female students with high extraversion showed more negative attitudes toward technology use for social purpose (Hamburger & Ben-Artzi, 2000). The inconsistent findings may be partly due to the nature of technology. Extraversion tends to have positive effects on technology that promotes social interaction and personal pleasure (McElroy et al., 2007; Svendsen et al., 2013), but it has negative effects on technology that focuses on task effectiveness and replaces social interaction (Barnett et al., 2015). Thus, we expect that the effects of extraversion on AI attitudes may be positive and significant on social aspects of attitudes toward AI, but the effects of extraversion on the other dimensions are exploratory.

Individuals with high agreeableness are motivated to maintain positive relations with others and they respond conflict situations more constructively (Graziano et al., 1996). Given the tendency to perceive conflicts less negatively (Graziano et al., 1996) and show more prosocial attitudes to out-group members (Graziano et al., 2007), agreeableness is likely to have positive associations with positive attitudes toward AI. Some empirical studies suggest that agreeableness is positively linked to perceived usefulness and intention to use new technology (Devaraj et al., 2008). However, the general findings about the effects of agreeableness have been inconsistent: Some studies showed positive associations (e.g. Devaraj et al., 2008), whereas some showed non-significant relationships (e.g. Barnett et al., 2015; McElroy et al., 2007). Because those with high agreeableness are motivated to develop and maintain prosocial relationships with others (Graziano et al., 1996), they tend to be compliant with others' opinion (Barnett et al., 2015; McElroy et al., 2007). Accordingly, their attitudes toward new technology are considerably impacted by perceived social norms and technology beliefs (Devaraj et al., 2008). When the technology fosters cooperation, agreeable individuals internalize the perceived usefulness of the technology and show higher levels of actual usage (Devaraj et al., 2008). However, in a context where cues of interpersonal cooperation and collaboration do not exist, the effects of agreeableness on new technology are not significant (Barnett et al., 2015; McElroy et al., 2007). Based on a few studies that examine on the role of agreeableness on technology usage and acceptance, we found the positive role of agreeableness tend to be observed when the technology was designed to facilitate collaboration with others (Devaraj et al., 2008) rather pursue individual own pleasure (McElroy et al., 2007). Although the influence of agreeableness on attitudes toward AI as a general entity is unclear, we expect the effects of agreeableness would be positive when the attitude concerns social harmony.

Those with high conscientiousness have a high need for achievement and thus likely to embrace AI if they perceive its competence and efficiency. Some empirical findings show positive relationships between conscientiousness and (perceived and actual) use of new technology (Barnett et al., 2015). However, it is also plausible that conscientiousness is associated with negative attitudes toward AI. Humans are threatened by the extraordinary performance outcomes of AI (Shank et al., 2019), and highly conscientious individuals may view AI as an obstacle to their work performance and job security. Individuals high in conscientiousness tend to be more sensitive to opportunities to show their strengths in work and feel more distress in response to work-related failures such as unemployment (Boyce et al., 2010). Additionally, according to prior research on the Big Five traits and internet usage (McElroy et al., 2007; Svendsen et al., 2013), non-significant relationships between conscientiousness and the Internet usage were found after accounting for all the other traits. The beneficial effects of conscientiousness were found only when the technology helps to promote task performance (Barnett et al., 2015) and fits their interest (Svendsen et al., 2013). Thus, we expect the positive and significant role of conscientiousness would be found in predicting AI attitudes that relate to performance and effectiveness.

Our review of existing studies on extraversion, agreeableness and conscientiousness suggests that the effects of personality traits on attitudes toward AI are likely to vary depending on whether the technology relates to social interaction versus functional dimension. Given this, we approach the questions regarding the relationships of AI attitudes with extraversion, agreeableness, and conscientiousness in an exploratory, open-ended manner.

Research Question: How are extraversion, agreeableness, and conscientiousness related to attitudes toward AI?

PIIT and AI Attitudes

Beyond the broad dimensions of personality traits such as the Big Five, people's attitudes toward a particular entity are closely shaped by their domain-specific personality (McAdams & Pals, 2006). The Big Five traits present a comprehensive framework in understanding personality at the high level of abstraction and generality: They are broad and relatively static, providing a rough outline of human individuality (McAdams & Pals, 2006). On the other hand, PIIT can be construed as an example of 'characteristics adaptations' that are domain-specific and amendable to environmental influences (McAdams & Pals, 2006; Thatcher et al., 2003). Along with the Big Five traits that provide a sketch of human individuation, investigating characteristics adaptations such as PIIT can fill in detail in human individuation (McAdams & Pals, 2006). Past studies showed that PIIT is known to be influenced by cultural and environmental factors such as uncertainty avoidance and perceived work overload (Thatcher et al., 2003), suggesting PIIT can be enhanced by changing external factors. Also, PIIT affects not only AI and technology acceptance but one's intention to accept technology-mediated education (Wang et al., 2012) and pursue IT career (Chen et al., 2016). Thus, we expect that findings on PIIT would help understand details in attitudes toward AI and provide guidelines on how educators develop positive attitudes toward AI and pursue relevant careers.

Research has shown that those scoring high on PIIT are more likely to perceive new technology to be useful and ease to use, and thus show more willingness to try new technologies (Agarwal & Prasad, 1998). Those high on PIIT are prone to experiment new technology and show more confidence to use new technology (Wang et al., 2012) and pursue IT careers (Chen et al., 2016). PIIT has associated with various types of attitudes toward technology such as perceived usefulness and perceived ease of use across cultures (Oostrom et al., 2013; Roh & Choy, 2018; Thatcher et al., 2003). As a proximal predictor of attitudes toward new technologies, the positive links from PIIT to intention to use technology have been observed after accounting for the effects of other Big Five traits (Gupta, 2021; Oostrom et al., 2013; Venkatesh et al., 2014). In studies using Indian middle-aged adults and students, PIIT explained positive attitudes toward electronic government use and it relates to intention to use computer-mediated education beyond and above the effects of the five traits (Gupta, 2021; Venkatesh et al., 2014; Wang et al., 2012). Although PIIT was positively correlated with openness across cultures (r = .20, p < .01 for Indian adults, r = .31, p < .01 for Dutch adults, r = .52, p < .01 for American college students) (Nov & Ye, 2008; Oostrom et al., 2013; Venkatesh et al., 2014), and the correlations were from moderate to weak (Cohen, 1988). Also, PIIT is known to be affected by work overload perceptions and cultural dimensions such as uncertainty avoidance (Thatcher et al., 2003) and other individual characteristics such as reactance to change (Nov & Ye, 2008). Unlike stable Big Five traits, PIIT is malleable and its nature is distinct from openness. Based on these findings, we expect PIIT would positively predict attitudes toward AI above and beyond the Big Five traits.

Hypothesis 3: Personal innovativeness in IT is related to positive attitudes toward AI.

Age as a Moderator

While personality traits are expected to directly affect AI attitudes, these effects may be contingent on the person's age. People are generally motivated to confirm their existing cognitive structures and attitudes that are shaped by traits, and choose situations that are compatible with their personality (Wrzus et al., 2016). However, with older age, people generally experience more constraints in their resources and environment, thus tend to select an environment that matches their personality (Wrzus et al., 2016). Due to these tendencies, the effects of personality on attitudes toward AI are likely to be stronger among older group than younger group. In fact, age accounts for significant variation in attitudes toward AI (Zhang & Dafoe, 2019), autonomous robots (Gnambs & Appel, 2019), and new technology (Broadbent et al., 2009), and younger people tend to be more open to accept and try our new experiences and new technology (Zhang & Dafoe, 2019). Older people tend to show more mistrust and fear toward new technology and feel less confident in using the new technology (Broadbent et al., 2009; Scopelliti et al., 2005). According to a recent survey using 2,000 American adults across ages (Zhang & Dafoe, 2019), being in an older group aged 54 and above is associated with showing less support for developing AI. 26% of those aged from 54 to 72 strongly or somewhat opposed AI development, and the percent increased to 32% among older groups aged 73 and above. In contrast, only 18% of younger groups (aged 18–37) opposed AI development. When comparing the effects of neuroticism and openness on social media use among older vs. younger groups, the effects were significant only in the older group (Correa et al., 2010). Based on these, we expect that the effects of personality traits on attitudes toward AI would be more pronounced for older group than younger group. Among the Big Five traits, we focus on two traits that reflect tendencies to be susceptible to new experiences (i.e. openness and neuroticism) and interaction between the two traits and age.

Openness, which encompasses basic receptivity to novelty and variety in experiences (Costa & McCrae, 1992; Woo et al., 2014), is associated with high levels of curiosity and intellectual abilities (Woo et al., 2014). Due to the tendency to seek out new experiences and exploring intellectual stimulation, openness buffers the negative effects of aging on individuals' cognitive engagement and abilities (Sharp et al., 2010). Because individuals high on openness are predisposed to ponder ideas and actively engage in cognitively stimulating activities, openness was found to be protective against losses in cognitive abilities and engagement among individuals aged over 50 (Sharp et al., 2010). Using and accepting new technology and agents such as AI requires certain learning ability and openness that enables to help cognitive development would play a beneficial role among older group. However, for younger group who tends to show positive attitudes toward AI (Zhang & Dafoe, 2019), the positive effects of openness on attitudes toward AI would be less pronounced compared to older group. Additionally, people with high openness tend to individuate unfamiliar groups of people, and thus feel more trust toward them (Saef et al., 2019); this tendency can be also expected to ameliorate the mistrust toward new technology amongst older people. Thus, we pose the following hypothesis.

Hypothesis 4: Age moderates the effects of openness on the attitudes toward AI such that the positive effects are stronger for older individuals than younger individuals.

The negative effects of neuroticism on attitudes toward AI may be more pronounced for older group than younger group. Those with high neuroticism experience greater exposure and reactivity to stressful events and employ less constructive coping strategies in response to conflicts (Bolger & Zuckerman, 1995). The negative attitudes of older group toward new technology are partly due to the lack of confidence in learning new things (i.e. difficulty with understanding the instructions and using new technology; Scopelliti et al., 2005). Individuals with high neuroticism are more likely to experience more negative emotions (e.g. threat and anxiety) in adopting new technology such as AI and the effects would be stronger for older group who feel fear in using new technology adoption than younger group. It has been found that neuroticism is negatively correlated with social media use only among adults over the age of 30, whereas the correlation was not significant among young adult group aged 18 to 29 years old (Correa et al., 2010). Therefore, we hypothesize the following:

Hypothesis 5: Age moderates the effects of neuroticism on the attitudes toward AI such that the negative effects of neuroticism are stronger for older individuals than younger individuals.

Method

Participants

We first recruited 1,330 participants through on online survey website. We included two attention check items (e.g. choose Strongly Disagree for this question). Out of 1,330 people who completed the survey, twelve participants failed to provide correct answers to the attention check items and were thus excluded from the analyses, resulting in a total of 1,318 valid responses. Participants of the first round survey consisted of 48.4% male and ranged in age from 19 to 49 years ($M = 33.91$, $SD = 8.01$). To collect participants from older age, we conducted an additional survey and collected 212 participants in their 50 s and above ($M = 53.42$, $SD = 5.86$).

In sum, a total of 1,530 participants participated in the survey ($M = 37.39$, $SD = 11.98$) and they ranged in age from 19 to 76. Specifically, participant's age as follows: below 30 years old, 28.56%; 30–39 years old, 28.43%; 40–49 years old, 29.15%; 50–59 years old, 7.12%; 60–69 years old, 6.34%; 70 years old and above, 0.39%. The skewness value of age was .51 and its kurtosis value was −.31, which of the two values shows that the sample was normally distributed.

Participant's educational level was as follows: elementary school degree, 0.07%; middle school degree, 0.26%; high school degree, 37.45%; bachelor's degree, 53.46%; master's degree, 6.93%; doctoral degree, 1.83%. Due to the small percentage of participants with lowest two and highest two groups, we grouped the educational levels into two groups: below bachelor's degree ($N = 578$), and bachelor's degree and above ($N = 952$).

Measures

For measures of Big Five personality traits, PIIT, and warmth and competence perceptions, we used existent Korean versions of scales that have been validated as detailed below. For measures of the other attitudes (i.e. need satisfaction, emotions, and behavioral intention), we identified previously validated Korean versions of the scales (see below) and modified the items to make them applicable to the current context of AI technology. After one industrial-organizational psychologist modified the items, two subject-matter experts—a professor in industrial-organizational psychology and a professor in the AI-Humanities field—reviewed the items.

Big Five Personality Traits and PIIT

The Big Five personality traits were measured with 15 items (Kim et al., 2011). The measures were translated and validated in Korean using The Big Five Inventory (BFI) developed by John and Srivastava (1999). The measure consists of five subscales each representing one of the Big Five traits. The translated measure has shown adequate validity and reliability in prior research (e.g. Kim & Kim, 2015). Sample items are: "I see myself as someone who is 'reserved (extraversion – reversed coded)', 'is helpful and unselfish with others (agreeableness)', 'does a thorough job (conscientiousness)', 'worries a lot (neuroticism)', and 'original and comes up with new ideas (openness)'." Our data showed adequate levels of internal consistency for all five subscales (αs = .73, .81, .86, .86, .91 for extraversion, agreeableness, conscientiousness, neuroticism, and openness respectively). PIIT was measured with four items (α = .88) from the scale developed by Agarwal and Prasad (1998), which has shown evidence of being a valid and reliable scale across cultures (e.g. Nov & Ye, 2008; Oostrom et al., 2013). We used an existent scale that was translated into Korean by Roh and Choy (2018). An example item is "I like to experiment with new information technologies." The Big Five traits and PIIT were rated on a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree).

Emotional Reactions

A total of eight items were used to measure emotional reactions toward AI. The emotion items were chosen based on previous research that examines people's emotional experiences in using and interacting with AI (Shank et al., 2019). Participants were asked to rate the extent to which they currently feel thinking about future changed by AI on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). Positive emotional attitude (or *positive emotion*) was measured with four emotions: excitement, amusement, happiness, and surprise. Negative emotional attitude (or *negative emotion*) was measured with four emotions: unease, confusion, fear, and disappointment. These discrete emotions are distinctively experienced among Korean adults, and we used existent Korean items that match each emotion (e.g. Choi & Choi, 2016). Both 4-item scales showed adequate internal consistency (α = .82 for positive emotion; α = .86 for negative emotion).

Cognitive Perceptions and Behavioral Intention to Use

Needs satisfaction was assessed with six items measuring each of the following three needs with two items: *autonomy*, *competence*, and *relatedness*. Consistent with the literature where need satisfaction is measured within a specific domain such as work (Broeck et al., 2010), we modified items to make it directly applicable to AI. We used a general basic needs satisfaction measure validated in Korean (Lee & Kim, 2008) and among original 18 items, we used six items due to survey length constraints. For example, "AI would allow me to decide things for myself and think more independently (autonomy), "Using AI would make me feel more capable and effective in performing tasks (competence)" and "Using AI would help me to build more reliable relationships with others (relatedness)." The items were rated on a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree). Our data showed adequate levels of internal consistency reliability for all three needs (α = .78 for autonomy need satisfaction, α = .66 for competence need satisfaction, and α = .89 for relatedness need satisfaction).

The *warmth* perception was measured with two items (α = .72) and *competence* perception was measured with two items (α = .81) developed by Fiske and colleagues (2002). The items have shown evidence of being a valid and reliable scale among Korean participants (Kim et al., 2019). Example items include "I think that AI is warm (warmth perception)" and "I think that AI is efficient (competence perception)." These items were rated on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). In addition, *behavioral intent to use AI*, which has been widely used in prior studies (e.g. Venkatesh & Davis, 2000), was measured with the following item on a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree). The item is "I intend to use products and service using AI."

Our factor analysis of these eleven attitudinal items suggested that the items can be reduced to two overarching factors. Cumulatively, the two factors explained 51.94% of the variance in the measures. Six items (i.e. two relatedness need satisfaction items, two autonomy need satisfaction items, and two warmth perception items) loaded on the first factor labeled as *sociality*. The other five items (i.e. two competence need satisfaction items, two competence perceptions, and one item of behavioral intention to use AI) were loaded on the second factor, which is labeled as *functionality*. Thus, our results below pertain to four distinct dimensions of AI attitudes: *positive emotion*, *negative emotion*, *sociality*, and *functionality*.

Control Variables

Based on prior research, we included gender, age, and prior experience with AI as control variables. It has been suggested that there are gender differences in how personality relates to technology use and its service (Hamburger & Ben-Artzi, 2000); and that younger people tend to show more positive new technology acceptance than older people (Scopelliti et al., 2005; Zhang & Dafoe, 2019). Research also suggests that prior experience makes a significant impact on how one develops his/her attitudes toward a new technology (Venkatesh & Davis, 2000). Gender was dummy-coded (0 = male, 1 = female), and age was entered as number of years. We measured prior experience with AI with one item, "Have you ever used service and products using AI?", which was rated with on a 7-point Likert scale (1 = not at all, 7 = very much).

Analytic Strategy

First, exploratory analyses were conducted to determine the factors of attitude items in this study, as described above. Second, to examine the first three study hypotheses (H1-H3) and the open-ended research question, we examined zero-order (bivariate) correlations of the study variables. To estimate the bivariate correlations of sociality and functionality with other study variables, factor scores of the two dimensions were calculated using the regression method (DiStefano et al., 2009). Then, a series of hierarchical regression analyses were performed to investigate how each personality variable of interest predicts the criterion when all the other relevant predictors and control variables were also taken into account. We first entered age, gender, and prior experience with AI as control variables, followed by the Big Five traits, and lastly PIIT. To examine the two hypotheses regarding the moderating roles of openness and neuroticism in the relationships between age and AI attitudes (H4-H5), we conducted regression analyses following the procedures recommended by Aiken and West (1991). Mean centering was used to minimize the collinearly problem in the regression analyses. Given that some of the measures were based on different Likert scales (5- vs. 7-point), we also standardized all scale scores for this analysis for easier interpretation. We conducted all the analyses using SPSS 25.

Results

Predicting AI Attitudes from Personality

Table 1 presents means, standard deviations, and bivariate correlations among the study variables and the two higher-order dimensions of AI attitudes as mentioned above (i.e. sociality and functionality). Table 2 presents the predictive relationships of the personality variables with emotional attitudes toward AI. After controlling for age, gender, prior experience with AI and the other personality traits, agreeableness and PIIT significantly accounted for variance in positive emotional attitude above and beyond the other variables, R^2 = .15, $F(9, 1520) = 30.20$, $p < .001$. Unlike Hypotheses 1 and 2, openness (β = .03, p =.308) and neuroticism (β = −.03, p =.283) did not have significant associations with positive emotional attitudes. Those with high agreeableness (β = .15, $p < .001$) and PIIT (β = .19, $p < .001$) showed higher levels of positive emotional attitude toward AI. The result on PIIT supports Hypothesis 3. The predictive effects of the other Big Five traits were not statistically significant. Together, the Big Five traits accounted for significant variance for the positive emotion with 5% additional adjusted R-squared values, $F(5, 1521) = 18.13$, $p < .001$, and PIIT explained an additional 2% of variance beyond control variables, $F(1, 1520) = 41.68$, $p < .001$.

In predicting negative emotional attitude toward AI, the results (Table 2) showed that all the personality variables except openness were significant predictors, $R^2 = .08$, $F(9, 1520) = 13.89$, $p < .001$. Unexpectedly, openness (β =.00, $p = .112$) was not significant after accounting for the other effects, not supporting Hypothesis 1. However, consistent with Hypothesis 2, those with high neuroticism showed more negative emotional attitude toward AI (β = .23, $p < .001$). Surprisingly, however, those high in extraversion (β = .06, $p = .025$) and agreeableness (β = .06, $p = .045$) also displayed more negative emotional reactions to AI. On the contrary, those high in conscientiousness (β = −.07, $p = .027$) and PIIT (β = −.11, $p = .001$) displayed less negative emotional attitude. Again, Hypothesis 3 was supported. The Big Five traits collectively explained 6% additional adjusted R-squared values, $F\ (5, 1521) = 19.53$, $p < .001$, and PIIT explained an additional 0.7% of variance, $F\ (1, 1520) = 11.42$, $p = .024$.

As shown in Table 3, the personality variables accounted for the sociality dimension of AI attitudes above and beyond the control variables, $R^2 = .15$, $F(9, 1520) = 27.61$, $p < .001$. Again, openness (β = .04, $p = .163$) was not significant unlike Hypothesis 1. Counter to Hypothesis 2, individuals with high neuroticism gave higher ratings of sociality (β = .05, $p = .039$), along with those with high agreeableness (β = .10, $p <$ .001) and PIIT (β = .12, $p = .001$). The positive role of PIIT was supported, consistent with Hypothesis 3. On the other hand, conscientiousness (β = −.09, $p = .002$) negatively predicted sociality, while extraversion (β =.01, $p = .667$) did not show significant predictive effects on the criterion. The Big Five traits accounted for the sociality

Table 1. Descriptive Statistics and Correlations of Study Variables.

	Mean	*SD*	1	2	3	4	5	6	7	8
1. Age	37.30	11.98	–							
2. Gender	0.51	0.50	−.06*	–						
3. Educational level	0.62	0.48	.50*	−.05	–					
4. Prior experience	4.11	1.22	−.20**	−13**	−.04	–				
5. Openness	4.39	1.14	−.07**	−.12**	.00	.41**	–			
6. Neuroticism	3.73	1.24	−.15**	.08*	−.07*	−.06*	−.13*	–		
7. Extraversion	3.86	1.04	−.15**	.04	.01	.24**	.29**	−.16**	–	
8. Agreeableness	4.53	0.95	−.01	.02	−.02	.22**	.39**	−.09**	.22**	–
9. Conscientiousness	4.94	0.97	.07**	.05*	.06*	.24**	.45**	−.19**	.16**	.40**
10. PIIT	4.20	1.19	−.05*	−.18**	.01	.48**	.52**	−.07**	.21**	.27**
11. Positive emotion	3.41	0.68	.10**	−.10**	.04	.23**	.24**	−.09**	.08**	.25**
12. Negative emotion	2.97	0.76	.03	.08**	.04	−.05*	−.07*	.23**	−.00	.00
13. Autonomy satisfaction	4.16	1.24	.22**	−.11**	.14**	.18**	.12**	−.06*	.02	.15**
14. Competence satisfaction	5.25	0.92	−.08**	−.03	.00	.10**	.21**	−.10**	.00	.23**
15. Relatedness satisfaction	3.56	1.29	.17**	−.05	.07**	.21**	.14**	.02	.07**	.12**
16. Warmth perception	2.79	0.76	.05	−.03	.05	.24**	.15**	.01	.07**	.13**
17. Competence perception	3.99	0.60	−.04	.03	−.08**	.11**	.22**	−.05*	−.02	.22**
18. Intention to use	5.15	1.07	−.03	−.09**	−.03	.30**	.31**	−.08**	.07**	.24**
19. Sociality	0.00	0.96	.16**	−.06*	.07**	.25**	.18**	−.01	.07**	.16**
20. Functionality	0.00	0.92	.02	−.01	−.05	.15**	.27**	−.09**	−.00	.27**

(*Continued*)

Table 1 (Continued).

	9	10	11	12	13	14	15	16	17	18	19
1. Age											
2. Gender											
3. Educational level											
4. Prior experience											
5. Openness											
6. Neuroticism											
7. Extraversion											
8. Agreeableness											
9. Conscientiousness	–										
10. PIIT	.32**	–									
11. Positive emotion	.21**	.31**	–								
12. Negative emotion	−.10**	−.12**	−.17*	–							
13. Autonomy satisfaction	.11**	.24**	.45**	−.10**	–						
14. Competence satisfaction	.28**	.22**	.49**	−.13**	.39**	–					
15. Relatedness satisfaction	.02	.18**	.43**	−.10**	.54**	.27**	–				
16. Warmth perception	.06*	.16**	.47**	−.09**	.42**	.22**	.66**	–			
17. Competence perception	.31**	.19**	.42**	−.10**	.21**	.57**	.06*	.15**	–		
18. Intention to use	.24**	.36**	.58**	−.23**	.37**	.49**	.27**	.30**	.43**	–	
19. Sociality	.08**	.23**	.54**	−.13**	.67**	.40**	.97**	.76**	.19**	.38**	–
20. Functionality	.35**	.26**	54**	−.15**	.39**	.81**	.16**	.23**	.93**	.61**	.32**

Notes. $N = 1530$. * $p < .05$; ** $p < .01$. Gender: male = 0, female = 1. Educational level: below bachelor's degree = 0, bachelor's degree and above = 1. PIIT = Personal Innovativeness in Information Technology. Sociality and Functionality are factor scores.

dimension with 2% adjusted R-squared values, F (5, 1521) = 7.36, $p < .001$, and PIIT explained an additional 1% of variance, F (1, 1520) = 15.89, $p = .001$.

Lastly, as shown in Table 3, all personality variables except neuroticism significantly predicted the functionality dimension of AI, $R^2 = .17$, $F(9, 1520) = 35.14$, $p < .001$. Consistent with Hypothesis 1, high levels of openness ($\beta = .07$, $p = .020$) were positively associated with the functionality dimension, but the role of neuroticism ($\beta = -.03$, $p = .127$) was found supporting Hypothesis 2. High levels of agreeableness ($\beta = .12$, $p < .001$), conscientiousness ($\beta = .21$, $p < .001$), and PIIT ($\beta = .13$, $p < .001$) were positively associated with the functionality dimension. Again, Hypothesis 3 was supported. However, extraversion ($\beta = -.12$, $p < .001$) was negatively associated with the criterion. The Big Five traits accounted for the functionality dimension with 16% adjusted R-squared values, F (5, 1521) = 48.79, $p < .001$, and PIIT explained an additional 1% of variance of the dimension, F (1, 1520) = 23.18, $p < .001$.

In addition, we conducted structural equation modeling (SEM) analysis to provide information on the construct-level effect sizes (i.e. taking into account measurement errors as well as the aforementioned control variables included). As fit indices, four fit indices such as the normed fit index (NFI), the comparative fit index (CFI), the root-mean-square error of approximation (RMSEA), and standardized root mean square residual (SRMR) in addition to χ^2 test. We allowed exogenous variables (i.e. personality factors, control variables) to covary based on prior research that showed significant relations between personality factors and prior experience of using technology, age, and gender (Barnett et al., 2015; Zhang & Dafoe, 2019) . The fit indices were $\chi^2 = 4687.48$ ($df = 537$), $p < .001$, RMSEA = .07, SRMR = .09, NFI = 84, and

Table 2. The Effects of Big Five Traits and PIIT on Positive Emotion and Negative Emotion.

	DV: Positive Emotion									DV: Negative Emotion								
	Step 1: Control Variables			Step 2: Big Five Traits			Step 3: PIIT			Step 1: Control Variables			Step 2: Big Five Traits			Step 3: PIIT		
	β	*SE*	*t*	β	*SE*	*t*	β	*SE*	*t*	β	*SE*	*t*	β	*SE*	*t*	β	*SE*	*t*
Constant	.06	.04	1.65	.07	.04	1.86	.04	.04	1.25	−.08	.04	−2.20*	−.07	.04	−1.83	−.05	.04	−1.50
Age	.15	.03	5.75**	.13	.03	5.01*	.12	.03	4.88*	.03	.03	1.10	.08	.03	3.05**	.08	.03	3.16**
Gender	−.11	.05	−2.30*	−.13	.05	−2.56**	−.09	.05	−1.72	.08	.03	3.06**	.06	.05	2.51*	.05	.05	2.05*
Prior experience	.25	.03	9.81**	.16	.03	5.83**	.10	.03	3.53**	−.04	.03	−1.40	−.01	.03	−.33	.02	.03	.77
Openness				.09	.03	3.08**	.03	.03	1.02				−.03	.03	−.10	.00	.03	.11
Neuroticism				−.02	.03	−.83	−.03	.03	−1.08				.23	.03	8.81**	.23	.03	8.96**
Extraversion				−.01	.03	−.24	−.01	.03	−.50				.06	.03	2.10*	.06	.03	2.25*
Agreeableness				.15	.03	5.66**	.15	.03	5.43**				.05	.03	1.84	.06	.03	2.00*
Conscientiousness				.06	.03	1.98*	.04	.03	1.33				−.08	.03	−2.57**	−.07	.03	−2.21**
PIIT							.20	.03	6.46*							−.11	.03	−3.38**
R^2		.08**			.13**			.15**			.01**			.07**			.08**	
ΔR^2		.08**			.05**			.02**			.01**			.06**			.01*	

Notes. $N = 1{,}530$. * $p < .05$, ** $p < .01$, PIIT = Personal Innovativeness in Information Technology. All predictors and the dependent variable are standardized.

Table 3. The Effects of Big Five Traits and PIIT on Sociality and Functionality.

	DV: Sociality									DV: Functionality								
	Step 1: Control Variables			Step 2: Big Five Traits			Step 3: PIIT			Step 1: Control Variables			Step 2: Big Five Traits			Step 3: PIIT		
	β	*SE*	*t*	β	*SE*	*t*	β	*SE*	*t*	β	*SE*	*t*	β	*SE*	*t*	β	*SE*	*t*
Constant	.01	.03	0.30	.01	.03	.21	−.01	.03	.86	−.02	.03	−.46	−.00	.03	−.07	−.02	.03	−.53
Age	.21	.02	9.01**	.23	.02	9.48**	.23	.02	9.40**	−.05	.02	−1.91	−.01	.02	−.30	−.01	.02	−.44
Gender	−.02	.05	−0.41	−.01	.05	−.29	.01	.05	.24	.03	.05	.64	.00	.05	.09	.03	.05	.73
Prior experience	.28	.02	11.78**	.25	.03	9.44**	.21	.03	7.71**	.15	.02	6.19**	.04	.03	1.46	−.00	.03	−.15
Openness				.08	.03	2.72**	.04	.03	1.40				.11	.03	3.95**	.07	.03	2.34*
Neuroticism				.05	.02	2.21*	.05	.02	2.07*				−.03	.02	−1.34	−.03	.02	−1.53
Extraversion				.02	.03	.59	.01	.02	.43				−.11	.02	−4.76**	−.12	.02	−4.98**
Agreeableness				.11	.03	4.07**	.10	.03	3.90**				.22	.03	8.59**	.21	.03	8.11**
Conscientiousness				−.07	.03	−2.73**	−.09	.03	−3.13**				.13	.03	5.14**	.12	.03	4.95**
PIIT							.12	.03	3.99**							.14	.03	4.82**
R^2		.11**			.13**			.14**			.02**			.16**			.17**	
ΔR^2		.11**			.02**			.01**			.02**			.14**			.01**	

Notes. $N = 1{,}530$. * $p < .05$, ** $p < .01$, PIIT = Personal Innovativeness in Information Technology. All predictors and the dependent variable are standardized.

CFI = .86. Agreeableness (β = .04, $p < .001$) and PIIT (β = .07, $p < .001$) were positively linked with positive emotional reactions to AI. Negative emotional reactions to AI was positively predicted by neuroticism (β = .13, $p < .001$), extraversion (β = .05, p =.054), and agreeableness (β = .06, p = .003), and negatively by conscientiousness (β = −.05, p = .026) and PIIT (β = −.09, p <.001). Sociality was positively predicted by neuroticism (β =.05, $p < 0.001$), agreeableness (β = .06, p = .001), and PIIT (β = .08, $p < .001$), and negatively by conscientiousness (β = −.09, $p < .001$). Functionality was positively linked with openness (β = .06, p =.001), agreeableness (β = .13, $p < .001$), conscientiousness (β = .21, $p < .001$), and PIIT: (β =.12, $p < .001$), and negatively with extraversion (β = −.16, $p < .001$) and neuroticism (β = −.03, p =.036). Overall, the SEM results were consistent with the hierarchical regression results, except that neuroticism showed a negative association with functionality in the SEM analysis, which was non-significant in the regression analysis.

In sum, consistent with Hypothesis 1, openness was positively associated with the functionality dimension of AI attitudes, but the predictive effects of openness on the other three types of AI attitudes were not significant after controlling for other variables. After PIIT was entered, the coefficients of openness tended to shrink and become non-significant. Hypothesis 2 regarding the negative associations between neuroticism and AI attitudes was also partially supported. Consistent with our hypothesis, neurotic individuals showed more negative emotional attitude of AI. However, they also showed more positive attitude in the sociality dimension, contrary to our expectation. The predictive effects of neuroticism on positive emotion and functionality were not significant. Finally, in full support of Hypothesis 3, PIIT had positive predictive effects on all of the four AI attitudes.

Interaction Effects

To examine moderating roles of age (Hypotheses 4 and 5), we conducted hierarchical regression analyses. In the first step, gender, prior experiences, and the other four Big Five traits except openness were entered. In the second step, recommended by Cortina (1993) openness, age, and the squared terms for age and openness were included as covariates. In the last step, the interaction term of openness and age was entered. As seen in Table 4, the results showed that the interplays between openness and age were not significant in predicting = positive emotion ($\beta = .01$, $p = .705$), negative emotion ($\beta = -.04$, $p = .111$), sociality ($\beta = .02$, $p = .519$), and functionality ($\beta < .01$, $p = .928$). The interaction did not add significant variance in explaining all of the four dimensions of attitudes toward AI. Thus, Hypothesis 4 was not supported.

Table 5 presents the results of interaction effects between neuroticism and age on the four types of attitudes toward AI. In the first step, gender, prior experience, and the other four Big Five traits except neuroticism were entered. In the second step, neuroticism, age, and the quadratic terms of age and neuroticism were entered. In the last step, the interaction term of neuroticism and age was entered. The results revealed that the interaction effects between neuroticism and age on positive emotion ($\beta = -.02$, $p = .420$), negative emotion ($\beta = .01$, $p = .573$), sociality ($\beta < .01$, $p = .989$), and functionality ($\beta = .02$, $p = .476$) were not found. Thus, Hypothesis 5 was not supported.

Discussion

Study Findings

Previous studies have indicated that personality traits predict attitudes toward new technology and autonomous robots and researchers have called for more research on the dispositional basis of attitudes toward AI (Santamaria & Nathan-Roberts, 2017; Schweinberger et al., 2020; Woods et al., 2005). This study responds to this call and adds to the growing body of literature on attitudes toward AI. Our findings indicate that the Big Five traits and PIIT contribute significant incremental variance to explaining individuals' attitudes toward AI. The effects remain significant after controlling for the effects of other traits and controls such as gender, age, and prior experience

Table 4. Moderating Effects of Age on the Effects of Openness.

	Positive Emotion		Negative Emotion		Sociality		Functionality	
	β	*t*	β	*t*	β	*t*	β	*t*
Step 1								
Gender	−.13	−2.61**	.13	2.58*	−.01	−.25	−.00	−.10
Prior experience	.16	5.81**	−.01	−.37	.25	9.39**	.04	1.68
Neuroticism	−.02	−.66	.22	8.58**	.05	2.07*	−.02	−.77
Extraversion	−.00	−.06	.05	1.84	.01	.47	−.10	−4.12**
Agreeableness	.15	5.56**	.05	1.92**	.11	4.13**	.12	4.73**
Conscientiousness	.05	1.86**	−.07	−2.42*	−.07	−2.69*	.22	8.56**
R	.33**		.25**		.29**		.39**	
R^2	.11**		.06**		.08**		.15**	
Step 2								
Openness	−.12	−.93	.24	1.73	.18	1.42	−.27	−2.29*
Age	.13	4.64**	.08	2.98**	.23	8.97**	−.03	−1.35
Openness squared	.02	1.67	−03	−2.01*	−.01	−.81	.04	3.22**
Age squared	.01	.47	−.02	−.87	−.01	−.58	.07	3.80**
R (Δ*R*)	.36**(.03)		.27**(.02)		.37**(.08)		.42**(.03)	
R^2 (ΔR^2)	.13**(.02*)		.07**(.01**)		.13**(.06**)		.17**(.02*)	
Step 3								
Openness x Age	.01	.50	−.04	−1.74	.02	.65	−.00	−.09
R (Δ*R*)	.36**(.00)		.27**(.00)		.37**(.00)		.42**(.00)	
R^2 (ΔR^2)	.13**(.00)		.07**(.00)		.13**(.00)		.17**(.00)	

Notes. *N* = 1,530. * $p < .05$, ** $p < .01$. All predictors and the dependent variable are standardized.

Table 5. Moderating Effects of Age on Effects of Neuroticism.

	Positive Emotion		Negative Emotion		Sociality		Functionality	
	β	*t*	β	*t*	β	*t*	β	*t*
Step 1								
Gender	−.13	−2.61**	.13	2.57*	−.01	−.27	−.00	−.01
Prior experience	.16	5.85**	−.01	−.39	.25	9.36**	.04	1.72
Openness	.09	3.02**	−.02	−.77	.08	2.75**	.09	3.29**
Extraversion	−.00	−.15	.05	1.94	.01	.52	−.10	−4.27**
Agreeableness	.15	5.49**	.06	2.00*	.11	4.09**	.12	4.71**
Conscientiousness	.06	2.01*	−.08	−2.54*	−.08	−2.73**	.22	8.55**
R	.34**		.14**		.28**		.40**	
R^2	.11**		.02**		.08**		.16**	
Step 2								
Neuroticism	−.04	−.35	.40	3.19**	.08	.67	−.53	−4.93**
Age	.12	4.48**	.09	3.10**	.23	9.03**	−.03	−1.35
Neuroticism squared	.00	.19	−.02	−1.40	−.00	−.23	.06	4.83**
Age squared	.01	.23	−.01	−.55	−.01	−.55	.07	3.44**
R (Δ*R*)	.36**(.02)		.26**(.12)		.36**(.08)		.42**(.03)	
R^2 (ΔR^2)	.13**(.02**)		.07**(.05**)		.13**(.05**)		.18**(.02**)	
Step 3								
Neuroticism x Age	−.02	−.81	.01	.56	.00	−.01	.02	.71
R (Δ*R*)	.36**(.00)		.26**(.00)		.37**(.00)		.42**(.00)	
R^2(ΔR^2)	.13**(.00)		.07(.00)		.13(.00)		.18**(.00)	

Notes. *N* = 1,530. * $p < .05$, ** $p < .01$. All predictors and the dependent variable are standardized.

with AI. Our data also reveal the differential effects of the Big Five traits and PIIT in predicting diverse types of attitudes.

Openness was only predictive of functionality, and not the other attitudes, when other predictors and control variables were also taken into account. The results are largely due to its close associations with PIIT and prior experience with AI. The correlation between openness and PIIT is strong (r = .52) and the correlation between openness and prior experience with AI is the largest (r = .41) among the five traits. In other words, individuals with high openness are innovative toward new technology and they are likely to have more prior experience with AI, which seems to be the main reason for the direct positive effects of openness found in previous research (Correa et al., 2010; Nov & Ye, 2008). Our supplementary analyses excluding PIIT and prior experience with AI support the argument: Openness is positively and significantly associated with positive emotion, sociality and functionality dimensional attitude toward AI after accounting for the other four Big Five traits. As supported by previous research findings (Nov & Ye, 2008), openness may precede a more specific trait related to innovation such as PIIT and the levels of engagement in new technology such as AI.

Our results revealed that those with high neuroticism do not always have negative attitudes toward AI. In line with the theoretical understanding of the neuroticism construct, we found that individuals who have high levels of neuroticism do display more negative emotion toward AI; however, these individuals tend to evaluate AI's sociality positively rather than negatively. Those with high neuroticism appear to view AI as warm and believe that the use of AI would satisfy their need for relatedness, although they may not necessarily believe that AI is functionally useful. These results are in line with prior research showing that neurotic individuals display a more positive attitude toward the use of internet for socialization (Hamburger & Ben-Artzi, 2000) and that they use the technology to achieve a sense of belonging in online activities (Amiel & Sargent, 2004). The positive association between neuroticism and sociality found in this study may also reflect neurotic individuals' need to belong *via* the use of AI or interaction with AI.

Those with high extraversion showed rather negative attitudes toward AI. They reported more negative emotional attitudes toward AI and evaluated functionality of AI negatively. Given the positive affective nature of extraversion (Lucas et al., 2008; Watson & Clark, 1992), the negative association between affective attitudes and extraversion is rather intriguing. The results indicate that what promotes extraverts' positive affect *in general* may be absent in the specific context of using and interacting with AI. In line with our results, some studies have witnessed negative associations between extraversion and actual use of technology (Barnett et al., 2015; Landers & Lounsbury, 2006). Researchers note that individualized nature of computer system that prevents social interaction may account for the negative effects (Barnett et al., 2015). The current study reveals a more nuanced finding. While the other Big Five traits show positive associations with the functionality dimensional attitude toward AI, extraversion is the only exception that associates with AI's functionality negatively. Individuals with high extraversion display the negative attitude in the functionality dimension, but not in the sociality dimension. Two central characteristics of extraversion are interpersonal engagement and incentive motivation (Depue & Collins, 1999) and extraversion' sociability does not fully account for the positive emotional experiences (Lucas et al., 2008). Extraverts' high sensitivity to reward leads them to engage in more activities including social interaction (Depue & Collins, 1999). Extraverts' negative emotional reactions and negative evaluation on AI's functionality may be attributed to the 'reward sensitivity' nature of extraversion rather than the 'active social engagement' nature. The agentic features of extraversion may lead extraverts to view new technology as a medium for their social activities and status (Correa et al., 2010), not as a substitute for human interaction, and these perspectives do not necessarily drive negative attitudes toward the sociality dimension of AI. However, the functionality dimension of AI, which potentially outperforms human performance and conflicts the existing reward structure, may boost extraverts' negative attitude toward the dimension.

The predictive effects of agreeableness on the attitudes toward AI were mostly significant and positive. Those with high agreeableness display positive emotion and positive attitudes in the sociality and functionality dimensions of AI. Given the magnitude of agreeableness's predictive effects are as large as PIIT, our study suggest that agreeableness uniquely and consistently contributes to positive attitudes toward AI even after taking into account other personality traits. Although studies to date have not focused much on agreeableness and its effects on the attitudes toward AI, its positive effects have been found in some research (Devaraj et al., 2008). Individuals scoring high on agreeableness reported higher perceived usefulness in new technology and the positive effects were stronger in a context with high levels of subjective norms (Devaraj et al., 2008). The beneficial effects of agreeableness on the attitudes toward AI found in this study may be partly due to the current environment that views the use of AI as a social norm. Our study shows that agreeableness is positively related to negative emotional reactions to AI. As argued by Graziano and colleagues (1996), their motive system to maintain positive social relations with others induces agreeable individuals to respond constructively in a negative emotion-triggered situation. Our study suggests that those with high agreeableness may exert efforts in displaying positive cognitive and behavioral attitudes despite of their ambivalent affective evaluations toward AI.

Conscientiousness is positively related to affective attitudes and functionality evaluation, while it is adversely associated with the sociality dimension of AI. For those with high conscientiousness, AI may be viewed as a functional supporter that helps achieve better performance and use their strengths, which could bring the more positive experiences. However, in line with the negative association between conscientiousness and sociality in this study, conscientious individuals' attitudes toward new technology have not been always found positive. It appears that their attitude toward new technology is contingent on their interest. Highly conscientious people tend to have more positive attitudes from the instrumental utility perspective (i.e. perceived ease of use) when their interest in the functions of a new technology domain is high (Svendsen et al., 2013). Conscientiousness has shown a positive association with time spent in academic domain while it has a negative association with the time in the leisure (Landers & Lounsbury, 2006). Also, as argued by Landers and Lounsbury (2006), the wide-open and unstructured nature of AI may not fit well with rule-following and structured characteristics of conscientious people, especially in the social domain.

The findings on PIIT consistently support its positive roles in predicting all the different types of attitudes toward AI in this study. Those with high PIIT show more positive and less negative affective attitudes, and perceive sociality and functionality of AI more positively. PIIT is the only personality construct that was found to play a positive role across all four attitudinal outcomes in our study. In particular, PIIT explains substantial variances in individuals' positive emotions and evaluations of functionality of AI. Our finding that those with high PIIT consistently exhibit positive attitudes across four types of attitudinal dimensions can inform key managerial decisions such as selection and placement, as well as training and development. In particular, PIIT has been shown to have associations with career and job choices. The levels of PIIT among college students majoring IT were positively related to their intention to pursue a career in IT (Chen et al., 2016) and PIIT was identified as a main characteristic of IT innovative leaders (Agarwal & Prasad, 1998). Based on these and results of our study, PIIT can be considered as one criterion in the selection and career decision process for employees and professionals in the AI fields.

The moderating roles of age in the effects of openness and neuroticism on AI attitudes were not significant in our study. The findings from previous research and the current study suggest that the effect of age on attitudes toward AI and new technology is relatively weak (Gnambs & Appel, 2019) and diverse (Gnambs & Appel, 2019; Zhang & Dafoe, 2019). A study (Gnambs & Appel, 2019) found a positive context effect of a country's age distribution such that European countries with a larger share of older citizens evaluated robotic assistance more favorably than countries with younger countries. As the societies evolve and older people embrace more opportunities to learn and use AI technology such as humanoid robots, the relation between age and attitudes toward AI is likely to evolve as well.

Our study also revealed that age is differentially related to various dimensions of AI attitudes. For example, age had positive effects on both positive and negative emotional reactions toward AI and it had a strong and positive association with the sociality dimension. Also, a curvilinear relationship between age and the functionality dimension was observed showing a U-shaped relation. Prior research on age and attitudes toward AI or social robots found the direction and strength of age on attitudes toward AI are diverse (Gnambs & Appel, 2019; Zhang & Dafoe, 2019). Depending on features of AI, general versus specific aspects of humanoid robots, the effects of age differ (Broadbent et al., 2009; Gnambs & Appel, 2019; Zhang & Dafoe, 2019). The effects of age may interact with features of AI technology or individual needs rather than interacting with personality factors. This signals a need for further exploration in future research to illuminate how age plays a role in predicting various types of AI attitudes.

Implications

To the extent of our knowledge, no published studies have included all of the Big Five personality traits (together with PIIT) and considered the diverse types of attitudes toward AI. Most previous research investigating the possible dispositional basis of attitudes toward AI or new technology has investigated individual personality variables in isolation, with only one aspect of personality or focused on a type of attitude (Barnett et al., 2015; McElroy et al., 2007; Woods et al., 2005). Our study findings provide a more comprehensive understanding of the relationships between personality and AI attitudes, which can be of value for theory building regarding the dispositional origins of individual differences in attitudes toward AI. Existing theories on technology acceptance (e.g. TAM theory) suggests that personality has indirect effects on attitudes through perceptions of usefulness and ease of use. However, increasing evidence suggests that personality also has direct influences on attitudes related to adoption of new technology (Barnett et al., 2015; McElroy et al., 2007). Additionally, the results of the current study showed that the Big Five traits and PIIT explain larger variance in predicting the functionality of AI than other types of attitudes. The findings support that future models of AI technology adoption deserve a dispositional component.

Also, our study covers different types of affective and cognitive attitudes, offering more fine-grained understanding of an individual's attitudes toward AI. One previous study found that the judgment about the functional dimension of AI is neither the only reason to use AI and nor a significant determinant of social judgment of AI (Gaudiello et al., 2016). AI comes with social and humane components (Gaudiello et al., 2016; Kaplan & Haenlein, 2019; Waytz et al., 2010). In interacting with the social agent, humans engage in social cognitive processes that not only involve information about efficiency and competence but also involve relational factors such as warmth and emotions (Fiske et al., 2007). Warmth and social evaluations even loom larger than efficiency evaluations at the first encounter; the warmth perception is a more primary dimension than competence judgment in social perceptions (Fiske et al., 2007). Our studies highlight the need to investigate diverse dimensions such as functionality, sociality, and emotional reactions toward AI in understanding attitudes toward AI.

As for practical implications, AI educators and developers need to consider how to help individuals regulate their negative affective attitudes such as threat while retaining positive emotions such as pleasure in interacting and using AI-based products and service. As shown in our study, understanding the user's personality characteristics can aid the specific teaching and designing strategies. Organizations can also benefit from the knowledge of the types of people who are likely to have positive attitudes toward AI. In particular, our findings that those with high PIIT and agreeableness consistently exhibit positive attitudes across four attitudinal dimensions can inform managerial decisions such as selection and training, when the organization focuses on AI implementation in their key work functions. Also, as AI technology offers more personalized services and products, our results provide implications for the development and marketing of AI. For example, recommending services and products to fulfill the need for relatedness in an approach that alleviates negative emotions would be particularly effective for individuals with high levels of neuroticism.

Limitations and Future Directions

Despite the contributions that our study brings to the literature, we should also note some limitations and directions for future research. The first limitation of our study is the relatively homogeneous nature and composition of the participants. The findings of this study were derived from relatively highly educated Korean adults. Research has shown that the fundamental worldviews and cross-cultural differences contribute differences in attitudes toward AI (Broadbent et al., 2009; Gnambs & Appel, 2019).

Cross-cultural differences were also observed in preferences in appearances of automated robots, the anticipated functions of AI, and reservations in ethical issues (Broadbent et al., 2009; Gnambs & Appel, 2019). We encourage future research that involves more diversity in the demographic and cultural characteristics of individuals to examine why such differences occur.

Second, we should note that our correlational findings are limited in testing causal processes and mediating mechanisms. Although causality cannot be experimentally tested in personality research, using longitudinal data of more than one repeated measurement of traits and attitudes would allow more grounded relations between personality and AI attitudes. For example, by applying the findings of this study in TAM theory, mediating mechanisms such as perceived usefulness and ease of use and on the roles of the social influence such as social norm can be empirically examined in future research.

Third, we should note that the effect sizes about the relations between the personality factors and the attitudes toward AI are relatively small, thus findings of this study should be interpreted with caution. The significant relations may be due in part to the relatively large number of participants in this study. Based on the findings of this study, future research using the predetermined number of participants is needed. Also, the hypotheses on moderating roles of age were not supported; there may exist more complex and interesting patterns on age, personality, and attitudes toward AI. As elaborated in the discussion section, investigation on non-linear relations between age and different facets of attitudes toward AI or changes in age, personality, and attitudes toward AI awaits future research.

Lastly, building from our results, we recommend the use of an integrated and comprehensive framework encompassing various dimensional attitudes in future research endeavors in this domain. Some studies have attempted to apply theories based on social perception (Fiske et al., 2007) or basic needs satisfaction (Deci & Ryan, 2000) and found that both warmth and competence dimensions influence satisfaction and intention to use the service using AI (Kim et al., 2019; Piçarra & Giger, 2018). In studying AI that features social components, individual differences related to social aspects should be taken into account regarding attitudes toward AI, which is absent in the existing technology-based theories. Integrating theories that cover affective and social aspects about interpersonal interactions with current technology theories such as TAM would enhance our understanding on the roles of the personality in predicting attitudes toward AI.

Conclusion

Who likes artificial intelligence? There is little doubt that AI is becoming a major part of our lives; there are growing controversies over predictors of attitudes toward AI. The present study reveals that attitudes toward AI are influenced by individuals' personality characteristics (Big Five traits and PIIT). In our study, those who are high on agreeableness and PIIT consistently showed positive attitudes as they favor AI technology emotionally, and evaluate sociality and functionality of AI positively. However, there exist more complex and nuanced relations about personality factors and attitudes toward AI, and the roles of personality in predicting AI attitudes differ across different types of attitudes (e.g. positive emotion, negative emotion, sociality, functionality). A comprehensive examination of affective, cognitive, and behavioral attitudes toward AI presents an improved sketch of human personality in predicting attitudes toward AI.

Data Availability Statement

Data available at https://osf.io/mep9q/.

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