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AI-powered recommendations: the roles of perceived similarity and psychological distance on persuasion

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ABSTRACT

Artificial intelligence (AI) plays various roles in our daily lives, such as personal assistant, salesperson, and virtual counselors; thus, it stands out in various fields as a recommendation agent. This study explored the effects of perceived similarity and psychological distance on the persuasion of AI recommendation agents through two experiments. Results of Experiment 1 elucidated that individuals feel more psychologically distant when they interact with AI recommendation agents than with human agents as a result of a different level of perceived similarity. Furthermore, psychological distance plays a mediating role in determining the effectiveness of desirability- vs. feasibility-focused messages in health-related issues. In Experiment 2, we manipulated the AI speaker's level of perceived similarity via anthropomorphism and found that the AI's recommendation with secondary (vs. primary) features is more effective when AI is humanized, and the reverse was found in non-humanized AI conditions. Both theoretical and managerial implications are provided.

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Artificial intelligence (AI); psychological distance; recommendation agent; construal level theory (CLT); anthropomorphism

Introduction

According to a report by Tractica (2016), the annual global revenue for artificial intelligence (AI) powered products and services will grow remarkably from $643.7 million in 2016 to $36.8 billion by 2025. Experts in academia and industry have predicted that shortly, AI will enjoy a social presence in our lives, in the form of assistants, friends, or even family members (Raghav 2018). AI agents are evident in various online platforms as well as offline places, including restaurants, airports, and shopping malls. Amazon, the world's largest retailer, announced that consumers who shopped through Amazon's AI agent Alexa during the 2018 holiday season tripled compared to 2017 (Simms 2019). There is no doubt that interactions between humans and AI will be more prevalent, and AI will prove to be extremely useful in our lives.

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Since AI plays various roles such as personal assistant, salesperson, and virtual counselors, it stands out in various fields as a recommendation agent. In particular, it is widely applied in healthcare and online shopping, and its prospects in these fields are infinite (Licholai 2019). Moreover, both online and offline stores employ AI-powered robots, agents, or kiosks to offer personalized recommendations to consumers according to their demographic information, tastes, needs, and lifestyles (Licholai 2019). While AI agents are being introduced to replace humans in various areas, it is still questionable whether they can completely replace human agents. In fact, consumers trust recommendations from friends more than AI regarding dating, job search, restaurants/bars, and TV/movie streaming apps. However, when using GPS mapping apps, AI is perceived as more reliable than friends (Baiju 2019), suggesting that the effectiveness of AI agent recommendation vary across domains, product/service types, and others. Thus, it is essential to understand the factors as well as the psychological mechanisms that affect the persuasion of AI agents.

Prior research on human-computer interaction (including AI and robot) has highlighted the importance of perceived similarity, and suggested that the similarity between human and robotic (computer, AI) agents affects the attitudes toward the agents (Nass et al. 1995; Nass and Lee 2001). The higher the perceived similarity is in terms of facial representation of computers (Gong 2008), cognitive functions (Krach et al. 2008), and personalities (Nass et al. 1995; Nass and Lee 2001), the more positive are the evaluations of AI agents. For example, individuals with dominance personality traits preferred computers with dominant characteristics than with submissive characteristics (Nass et al. 1995). Furthermore, when robots' facial look was designed like a human face, it resulted in more positive evaluations of human-robot interactions (Duffy 2003; Phillips et al. 2018). That is, prior research has suggested that perceived similarity is one of the most powerful factors in determining the interaction between human and AI agents.

Past studies have mainly centered on the main effects of similarity on the human-AI interactions (Bickmore and Cassell 2001; Fink 2012; Gong 2008; Morkes et al. 1999; Nass et al. 1995; Nass and Lee 2001). However, to the authors' best knowledge, no research yet has investigated the persuasive effect of AI depending on the level of similarity. To increase the understanding of interactions between human and AI agent and provide guidance for practitioners, we aim to explore the effects of similarity-driven psychological distance to AI agent on the persuasion effect of the message from it. To be specific, the current study examines the mediating role of psychological distance in the relationship between perceived similarity and evaluation of the AI agent. In fact, substantial research has established that perceived similarity toward the target object affects the psychological distance toward as well as preference for the object (Liviatan et al. 2008; Tajfel 1982; Triandis and Triandis 1962; Young 2015). In the current study, we predict that the level of perceived similarity affects the psychological distance toward recommendation agents, which results in the effectiveness of persuasive messages of the recommendation agents. The interactions between humans and AI are more critical and prevalent than ever, nevertheless it is yet to be fully understood. By revealing the psychological mechanism, our study offers theoretical implications and suggests the importance of similarity-driven psychological distance on the persuasion effect of

AI agent. The findings of the study also indicate certain managerial implications for digital marketers as well as AI agent developers.

Theoretical framework

Human-AI interaction and similarity

AI technology has espoused human learning, reasoning, perceptual skills, and understanding of natural language through computer programs (Brooks 1991). Although it has been the biggest issue in the industry only in recent years, research on AI has been conducted for decades. From the 1980s, when the use of computers began to grow, researchers began studying the effects of AI on our lives. In the early days, researchers were interested in the technical aspects of AI, including its direction of development (Glover 1986) and the prediction of its potential for use in medicine and engineering (Szolovits et al. 1988).

Of late, an AI-powered recommendation service known as an AI agent that interacts directly with humans has been drawing much attention in academia (Kim et al. 2019). The devices with AI-powered recommendation services like smart speakers are entering the market to meet consumers' needs. Such devices are ultimately designed to interact with humans as a natural social actor (e.g., assistant, doctor, friend; Reeves and Nass 1996). Interactions between humans and AI agents are more important than ever, and both academia and industry have a great interest in the exchanges (Kim et al. 2019; Nass et al. 1997; Nass and Lee 2001). For example, individuals perceived the AI's warmth or competence differently, depending on which social role of AI (i.e., friend or servant) they interacted with. (Kim et al. 2019).

Prior research has shown that similarity is one of the most critical factors that affect not only interpersonal relationships (Ajzen 1974; Byrne 1997; Lazarsfeld and Merton 1954) but also interaction with other inanimate objects such as AI. The results from social psychology have proven that individuals are not only more attracted to others who are perceived to have similar personalities, but they also tend to be more influenced by them during interpersonal interaction (Ajzen 1974; Byrne 1997). Numerous empirical studies in human-computer interactions have suggested that the perceived similarity of computer agents affects an individual's attitude toward the agents (Bickmore and Cassell 2001; Fink 2012; Gong 2008; Morkes et al. 1999; Nass et al. 1995; Nass and Lee 2001). Thus, it seems reasonable to suggest that the perceived similarity of AI plays a significant role in determining the attitude toward and interaction with AI. If an AI exhibits a trait considered unique to humans (e.g., language, appearance, or personality) in interactions, individuals consider it to be similar to them, thereby forming a more positive attitude (You and Robert Jr 2018). Prior research has also suggested that individuals prefer computers that have similar characteristics to them (Bickmore and Cassell 2001; Nass et al. 1995; Fink 2012; Gong 2008; Morkes et al. 1999; Nass and Lee 2001) because they tend to expect a target that is similar to them, to think and act like they would (Berger and Calabrese 1975; Eddy et al. 1993). By contrast, when individuals interact with dissimilar targets, they have difficulty in predicting how the target will behave and they feel relatively uncomfortable (Berger and Calabrese 1975; Eddy et al. 1993; Epley et al. 2007).

Although prior research has shown the positive effects of similarity on the human-computer interactions, no research yet has examined the persuasive effect of AI across the different level of similarity. According to construal level theory (CLT; Trope and Liberman 2010), individuals perceive the psychological distance to an object differently depending on the similarity between the object and themselves, and the psychological distance affects individuals' construal level which is the way to interpret the object (Liviatan et al. 2008; Stephan et al. 2011). Individuals prefer different messages sent by the object depending on the construal level primed by the psychological distance to the object (Theodorakis and Painesis 2018; Martin et al. 2009). The current study aims to reveal the effects of similarity-driven psychological distance to AI agents on the persuasion effect of the message sent by AI agents.

Similarity-driven psychological distance to AI agents

Psychological distance is the concept that defines how psychologically close or far away a certain object is (Trope and Liberman 2010). Psychological distance is determined by time, space, probability, and social distance between the self and the object (Trope and Liberman 2010). For example, individuals perceive themselves to be psychologically distant to the target when it is temporally far (one week vs. one year), spatially far (domestic vs. foreign), probabilistically less (traffic jam vs. lottery), or socially different (same vs. different race). The similarity between oneself and a target depends on how many attributes they share (Heider 1958), and the similarity between oneself and a target affects the social distance to the target (Heider 1958; Hyde 2005). If a target has similar attributes (e.g., culture, economic or social status, political view) as themselves, individuals judge that the target is socially close to them (Heider 1958). Prior research has found that individuals feel psychologically close to someone who has similar attributes with them (Liviatan et al. 2008; Tajfel 1982; Triandis and Triandis 1962). Liviatan and colleagues (2008) found that individuals felt psychologically close to those who shared similar attributes (e.g., same last name, same class experience) with them than those who did not.

Humans and AI are different. AI is an inanimate machine, not a human being. It not only has a different appearance from human beings, but also has no human attributes such as emotions or free will. Inferring from the fundamental differences between human beings and AI, it is expected that individuals perceive AI agents as less similar to them than human agents. Furthermore, based on previous findings that perceived similarity affects the psychological distance to the target, individuals perceive AI agents as more psychologically distant compared to human agents. As individuals have less in common with AI than with another human being, it is expected that they feel psychologically close to human agents similar to them. Conversely, for AI agents that are not relatively similar compared to human agents, individuals feel more psychologically distant. Thus, the following hypothesis is put forth:

H1: Individuals feel psychologically closer to human agents than to AI agents.

Construal level theory (CLT)

The psychological distance to a target affects the way individuals interpret it. Individuals interpret a target that feels psychologically close through a lower level of construal, while a target that feels psychologically distant is interpreted through a higher level of construal (Trope et al. 2007). According to Trope and Liberman (2010), a higher level of construal interprets the target as something with abstract, deciphered, and primary characteristics, whereas a lower level of construal analyzes the target as something with concrete, contextualized, and secondary characteristics. Trope and Liberman (2010) insisted that when interpreting the message from psychologically distant targets, individuals think about why they should accept the message. They notice the desirability of the message that stresses on the "why" aspect.

In contrast, in the case of a message from psychologically close targets, individuals think about how they follow the message. They do so to focus on the feasibility of the message that stresses on the "how" aspect. Also, in another study, when consumers intended to buy a radio tomorrow (psychologically close), they gave a more positive assessment of the radio highlighting its secondary features (e.g., clock) than the radio with primary features (e.g., sound). On the other hand, when consumers intended to buy a radio a year from now (psychologically distant), they preferred the radio with primary features to the radio with secondary features (Trope and Liberman 2000). Findings suggest that when the message was interpreted through a low construal level, individuals rated the message that stressed on feasibility or secondary features more positively than the message that emphasized desirability. By contrast, the message that emphasized desirability received a better evaluation than the one with an emphasis on feasibility and primary characteristics when interpreting it through a high construal level (Ledgerwood et al. 2010; Trope and Liberman 2000).

According to the CLT, the psychological distance to a target is affected by time, space, social distance, and probability (Trope et al. 2007). Of these, social distance is affected by the similarity between the target and oneself (Bar-Anan et al. 2006; Liviatan et al. 2008). Individuals view the target's behavior as more concrete and positively evaluate the description of the target with feasibility than with desirability when the target is similar to them. When the target is dissimilar to them, they depict the behavior as abstract and positively evaluate the description with desirability (Liviatan et al. 2008). Based on the above discussion, we predicted that for human agents who are relatively similar to individuals, the message would be more persuasive, emphasizing feasibility more than desirability. Conversely, for AI agents who are relatively dissimilar to individuals, the message focusing on desirability will be more persuasive than the messages emphasizing feasibility. Thus, the following hypotheses and conceptual model (Figure 1) are put forth:

H2: When an AI (vs. human) agent delivers a message that emphasizes desirability (vs. feasibility), the persuasiveness of the message will be stronger.

H3: The psychological distance to the agent will mediate the interaction effect between perceived similarity and message type on the persuasiveness of the message.

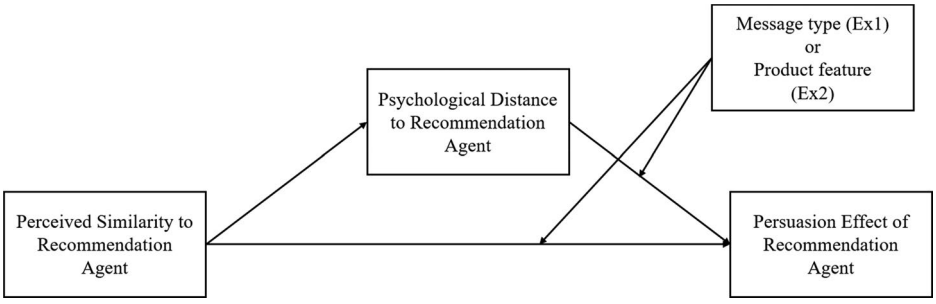

Figure 1. Conceptual model of the proposed hypotheses.

Experiment 1

Experiment 1 was designed to test the persuasive effects of the different level of perceived similarity of recommendation agents promoting the health benefits of drinking water. First, we examined that the psychological distance varies on level of perceived similarity to an agent (i.e., human vs. AI) (H1). Then, we investigated how perceived similarity of recommendation agent (human vs. AI) and message types (feasibility vs. desirability) interplay in determining the persuasive effects of the agent (H2). Lastly, we tested that the psychological distance to agent will mediate the interplay (H3). Thus, a 2 (perceived similarity: human vs. AI) × 2 (message type: feasibility vs. desirability) between-subjects design was employed to test our proposed hypotheses.

Participants

A total of 120 college students (mean age = 23.97 years; 59% female) were recruited from a major university in Seoul, Korea. They participated in an online experiment in exchange for a $5 gift card and were randomly assigned to one of the four experimental conditions (30 participants in each).

Stimuli, procedure, and measures

The perceived similarity and messages were manipulated in the study. First, to manipulate the perceived similarity (human vs. AI), a family medicine doctor was used for the human agent condition, and an AI medical service agent was employed for the AI agent. The message type was manipulated by referring to previous CLT literature (e.g., Trope et al. 2007), which suggests that a high-level construal is concerned with the desirability of an action (i.e., "why we should drink water regularly"), while a low-level construal focuses on the feasibility of an action (i.e., "how we can drink water regularly") (Trope et al. 2007). As a result, in the desirability condition, the recommendation agent's message emphasizes three reasons why we should drink water more, whereas, in the feasibility condition, the message focuses on how to drink more (enough) water.

Upon agreeing to participate in the experiment, participants received an online link and were randomly assigned to one of the four conditions. First, the participants encountered the recommendation agents, and they read the introduction of the agents. The introduction included the agents' career and capabilities. In the human agent condition, which is a family medicine doctor as an agent, the doctor graduated from a top-ranked medical school and operated a hospital, and the doctor also wrote books about healthy lifestyles. The AI has been introduced as a healthcare adviser in large hospitals and research facilities, and was created by a top IT company. Then, they were asked to carefully read the message regarding tips for healthy habits of drinking water delivered by either a human or an AI agent. Finally, they were then asked to answer a series of questions, including dependent variables and message type manipulation check items.

To assess whether the types of recommendation agent were manipulated as intended, participants were asked to evaluate the recommendation agents in terms of perceived similarity (1 = socially dissimilar, outgroup, different member of society; 7 = socially similar, in-group, same member of society; α = .84). Manipulation check items for the message type consisted of three items rated on the seven-point Likert scale (1 = the message stressed 'how' to make the right healthy habit of drinking enough water, the message was 'concrete', the message stressed 'process'; 7 = the message stressed 'why' I have to make the right drinking habit, the message was 'abstract', the message stressed 'goal'; α = .78) (Ledgerwood et al. 2010). The closer the score is to one point, the more emphasis is on feasibility, and if the score is close to 7, the more emphasize on desirability.

In addition, participants were asked the psychological distance to the agent (i.e., mediator). We used the Inclusion of Other in Self Scale, which is a measurement for interpersonal closeness (Aron et al. 1992). The participants were asked to choose the picture that best described the relationship between them and the recommendation agent. The closer to 1, the farther the relationship, the closer to 7, the closer the relationship. The measurement has been validated through many studies (Liviatan et al. 2008). To control the potential confounding effects of the agent's expertise, the perceived expertise of the recommendation agent (expertise, smartness, skillfulness, α = .89) was measured and controlled as a covariate. Finally, the level of health involvement was measured and controlled in the analyses.

Finally, two dependent variables were employed to measure persuasive effects of recommendation agents: message attitude (1 = bad, unreliable, not useful; 7 = good, reliable, useful; α = .90) and agent attitude (1 = bad, unreliable, not useful; 7 = good, reliable, useful; α = .84) as past research has shown that both message attitude and agent attitude are meaningful indicator of AI persuasion (Sallam and Wahid 2012; Tsang et al. 2004). Also, the agent attitude has a crucial influence on the persuasion effect. A single index for each of the dependent variables was formed by averaging the corresponding items.

Results

The results of manipulation checks showed that the perceived similarity of the agent was significantly higher in the human agent condition ($M = 5.08$) than in the AI agent condition ($M = 1.88$; $p < .001$), suggesting that the agent type manipulation was

successful. Also, participants in the desirability condition indicated that the message related to desirability more ($M = 5.70$) than those in the feasibility condition ($M = 2.23$; $p < .001$). Thus, the manipulations of the two independent variables were successful. Additionally, the results showed that the difference in expertise between the two agents was not statistically significant (AI: $M = 4.94$; human: $M = 5.03$; $p = .618$).

First, to test H1, an independent samples *t*-test was conducted. The results showed that the participants in the human agent condition felt significantly psychologically closer ($M = 4.35$) than did in the AI agent condition ($M = 2.42$; $p < .001$), thereby supporting H1. Further, a 2 × 2 ANCOVA was conducted to test an interaction of agent × message on the two dependent variables. No significant main effects for agent (message attitude: $p = .274$; agent attitude: $p = .299$) and message (message attitude: $p = .773$; agent attitude: $p = .928$) were observed. As predicted, however, the agent × message interaction effect was significant for both dependent variables (message attitude: $F = 11.28$, $p < .001$, $\eta p^2 = .09$; agent attitude: $F = 14.11$, $p < .001$, $\eta p^2 = .11$). Subsequent contrast analyses showed that a human agent is more persuasive when it conveys feasibility-focused messages (message attitude: $M = 5.12$; agent attitude: $M = 5.00$) than desirability-focused messages (message attitude: $M = 4.44$; agent attitude: $M = 4.37$; $ps < .001$). In contrast, when the recommendation agent was an AI, the desirability-focused message induced a more positive attitude toward the message ($M = 4.85$) as well as the agent ($M = 4.83$) than did the feasibility-focused message (message attitude: $M = 4.28$; agent attitude: 4.17; $ps < .001$). Control variables were not significant ($ps > .1$). Overall, the results lend support for H2 (see Figure 2).

To further test our proposed model (H3), we tested the conditional indirect effect for the dependent variables. We used the 3.5 version of the SPSS process created by Hayes for estimating the indirect effect (Hayes 2017). We adopted the 15th model from Hayes's templates (Hayes 2017) to statically analyze our model. In our model, the independent variable was agent type (human vs. AI), the mediator was the psychological distance to the agent, the moderator was message type (feasibility vs. desirability), and control variables were agent expertise and health involvement. Dependent variables were the attitude toward message and agent. In this process, mediation does not require the direct effect of the independent variables on the dependent variables (Preacher et al. 2007). We coded human agent as −1 and AI agent as 1, message feasibility as −1 and message desirability as 1. Statistical tests included a series of bootstrap analyses with 5000 samples and 95% bias-corrected confidence intervals (Preacher et al. 2007).

The results showed that the conditional indirect effect was statistically significant (Model 15; Hayes 2017). The results of the effect of the recommendation agent type on psychological distance was significant ($B = -1.91$, $SE = .20$, $p < .001$). For dependent variables, the agent did not show a statistically significant effect on message attitude ($B = .86$, $SE = .66$, $p = .194$). But, the effect of psychological distance to message attitude was statistically significant ($B = 1.67$, $SE = .27$, $p < .001$). We did not assume this result, but it signifies that when individuals feel psychologically close to the agent, they are more favorable toward the message from the agent.

More importantly, we revealed that the psychological distance to the agent mediates the interaction agent × message type on message attitude. The interaction effect between agent type and message type was not significant ($B = -.70$, $SE = .42$, $p =$

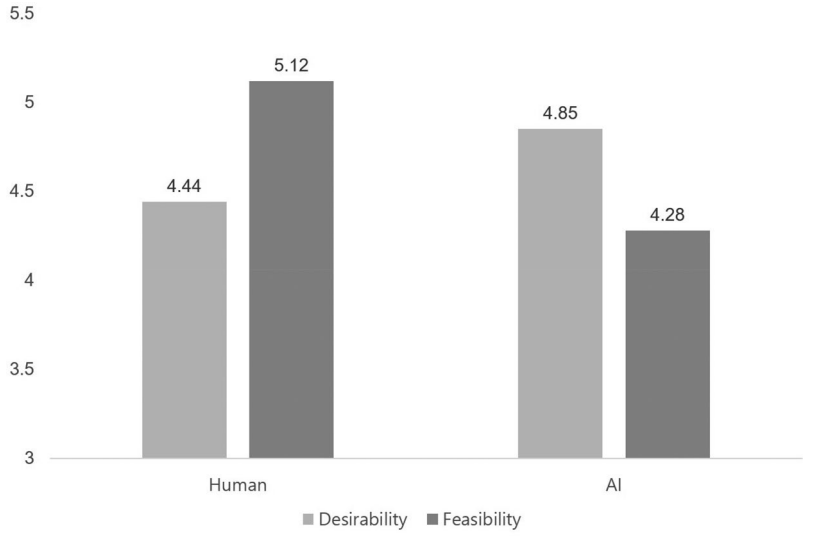

Figure 2. Perceived similarity to agent × message type on message attitude (Experiment 1).

.097). However, the interaction effect between psychological distance to the agent and message type was statistically significant ($B = -1.12$, $SE = .15$, $p < .001$). To be more specific, the psychological distance positively affects message attitude in a feasibility message condition ($B = .55$, $SE = .11$, $p < .001$; 95% CI = .33 to .76), whereas it negatively affects message attitude in a desirability message condition ($B = -.58$, $SE = .10$, $p < .01$; 95% CI = −.78 to −.38). We observed the same pattern for the attitude toward agent (see Table 1). Hence, our H3 was also supported.

Discussion-in-brief

In line with the expectations, the results of Experiment 1 demonstrate that individuals feel AI agents are more psychologically distant than human agents. Further, the findings show that the psychological distance between participants and recommendation agents plays a critical mediating role in determining the effectiveness of desirability-focused versus feasibility-focused messages. However, as study 1 compared human and AI agents, there are possibilities for other confounding factors that may affect psychological distance toward the agents. In addition, it is expected that a variety of AI will become more humanized and play various relationship roles, including partners, friends, secretaries, and pets. For example, Toyota attempts to release robots for not only helping with chores but also offering companionship (Buckland 2018). Amazon is currently developing its Alexa to play games with users or tell jokes to its users (Coughlin 2018). Thus, it is expected that consumers will interact with AI with a more "human-like" feel in the near future.

To address this issue, in Experiment 2 we further test the psychological distance to AI agents that can be successfully manipulated by the level of anthropomorphism of AI agents. Previous studies have proved that individuals tend to perceive that the anthropomorphized target feel more similar to them than the non-anthropomorphized

Table 1. Conditional indirect effect of perceived similarity to agent × message type on message/agent attitudes (Experiment 1).

First Equation: Dependent Variables						
	Message Attitudes			Agent Attitudes		
	B	*SE*	*p*	*B*	*SE*	*p*
Perceived similarity (X)	−2.36	.58	< .001	−1.79	.60	< .01
Message type (MO)	−.13	.10	.157	−.08	.07	.203
X × MO	1.51	.37	< .001	1.14	.38	< .01
Agent's expertise (CO1)	.43	.10	< .001	.35	.10	< .001
Health involvement (CO2)	.09	.07	.207	.10	.07	.171

Second Equation: Psychological Distance			
	B	*SE*	*p*
X	−1.91	.20	< .001
CO1	.03	.10	.752
CO2	.08	.07	.252

Third Equation: Dependent Variables						
	Message Attitudes			Agent Attitudes		
	B	*SE*	*p*	*B*	*SE*	*p*
X	.86	.66	.194	1.21	.73	.100
Psychological distance (ME)	1.67	.24	< .001	1.56	.26	< .001
MO	4.70	.24	< .001	4.90	1.15	< .001
X × MO	−.70	.41	.098	.92	−.88	.06
ME × MO	−1.12	.15	< .001	-.43	−1.03	< .001
CO1	.28	.08	< .01	.22	.10	< .05
CO2	.10	.05	.085	.11	.07	.091

one (Connell 2013; Epley et al. 2007; Moreno and Flowerday 2006). Hence, anthropomorphizing an object leads individuals to feel psychologically close to the target. Thus, the following hypothesis is developed:

H4: Individuals feel psychologically closer to anthropomorphized AI than to non-anthropomorphized AI.

Further, in Experiment 1, we used the message regarding tips for healthy habits of drinking water, and the message type was manipulated by emphasizing feasibility or desirability. To further increase the external validity of our findings, participants were presented with a message providing personalized recommendations of product. Individuals show differences in preference according to construal level (Trope and Liberman 2000). Specifically, when the message is interpreted through a low level construal, individuals evaluate the message highlighting secondary over primary features, while for a high level construal, individuals prefer the message highlighting primary than secondary features. Thus, we put for the following hypotheses:

H5: When an anthropomorphized AI agent (vs. non-anthropomorphized AI) delivers a message that emphasizes secondary features (vs. primary), the message's persuasiveness will be stronger.

H6: The psychological distance to the agent will mediate the interaction effects between perceived similarity and message type on the persuasiveness of the message.

Experiment 2

To replicate and extend the results of Experiment 1, we again tested the psychological distance between participants and recommendation agents plays a critical mediating role in determining the message persuasiveness. Hence, a 2 (perceived similarity: anthropomorphized AI agent vs. non-anthropomorphized AI agent) × 2 (product feature: primary vs. secondary features) between-subjects design was employed. However, here human-AI interaction was manipulated through AI speaker and voice. In addition, another product category, that of air purifier, was employed for stimulus recommendation to increase the generalizability of the findings. Also, two new dependent variables (i.e., product attitude and purchase intention) were used in Experiment 2 as both anthropomorphized and non-anthropomorphized AI agents recommend a specific product (i.e., air purifier).

Participants

A total of 120 college students (mean age = 22.78 years; 61% female) from a major university in Seoul, Korea participated in the laboratory experiment and were offered $5 as compensation. They were randomly assigned to one of the four experimental conditions (30 participants in each condition).

Stimuli, procedure, and measures

We employed the appearance of an AI speaker to manipulate perceived similarity (Hur et al. 2015; Kim and McGill 2011; Kim et al. 2016). Specifically, we used an AI speaker with eyes and a headset design for the anthropomorphized AI agent and a speaker with a cylindrical design for the non-anthropomorphized AI agents. Both AI speakers were chosen to be similar in size and color. Also, to manipulate the product features, participants were presented with a message recommending an air purifier with either primary or secondary features. In the "primary features" condition, the AI agent emphasized its air purification ability like 'it can purify the air automatically and perfectly through advanced air purification filter.' In the "secondary features" condition, the AI agent recommended an air purifier emphasizing its beautiful design, light weight, and portability.

Once participants entered the laboratory, they were introduced to an AI speaker to be used in the experiment and then were asked to answer questions regarding their preference for the AI speaker's appearance (1 = negative, bad, unfavorable; 7 = positive, good, favorable; $\alpha = .92$), which was a covariate. After completing the questions, participants began interacting with a manipulated AI speaker. The interaction consisted of self-introduction, asking questions about air pollution, and getting air purifier recommendations. We used the Wizard of Oz method to make participants believe they were interacting with a real AI speaker instead of a manipulated one as a control (Dahlbäck et al. 1993). Following the interactions with AI, participants responded to a series of questions, including manipulation checks and dependent variables.

We did a manipulation check for product features through three items (i.e., the product stressed on "primary attributes," the features were related to "core function,"

and the AI speaker promoted "goal-relevant features"; α = .81). As the score is closer to 7 (vs. 1), it can be interpreted that the features of the product recommended by the AI speaker is primary features (vs. secondary features). Further, the level of anthropomorphism of AI speaker was measured with the questions used by Hur et al. (2015). Both perceived similarity (α = .74) and psychological distance were measured with the same set of questions as in Experiment 1. Finally, two dependent variables assessed the effectiveness of AI recommendation: product attitude (1 = negative, bad, unfavorable; 7 = positive, good, favorable; α = .92) and purchase intention (1 = never buy, no need; 7 = buy, need; α = .76). A single index for each dependent variable was formed by averaging the corresponding items.

Results

The results showed that the level of the AI agent's anthropomorphism was significantly higher in the anthropomorphized AI agent condition ($M = 3.90$) than in the non-anthropomorphized AI agent condition ($M = 1.75$; $p < .001$). Further, participants in the AI agent's anthropomorphism condition reported a higher score of perceived similarity with the AI agent ($M = 3.21$) than participants in the non-anthropomorphized AI agent condition ($M = 2.06$; $p < .001$). Furthermore, the primary features condition showed a higher score ($M = 6.20$) than secondary features condition ($M = 2.05$; $p < .001$). Thus, we successfully manipulated all factors.

The result shows that participants felt more psychologically closer to the anthropomorphized AI agent ($M = 4.05$) than non-anthropomorphized AI agent ($M = 2.60$; $p < .001$), supporting H4. In addition, the results of ANCOVA showed that the main effects of the two independent variables ($ps > .1$) were not significant. However, the interaction effects between perceived similarity and product feature on product attitude ($F = 17.36$, $p < .001$, $\eta^{p\ 2} = .13$) and purchase intention ($F = 13.28$, $p < .001$, $\eta^{p\ 2} = .10$) were statistically significant. Subsequent contrast analyses demonstrated that participants in the anthropomorphism condition gave more positive scores to the recommended product with secondary features (attitude: $M = 4.97$; purchase intention: $M = 4.08$) than with primary features (attitude: $M = 3.99$; purchase intention: $M = 3.33$; $ps < .001$). In contrast, participants in the non-anthropomorphized AI agent condition showed more positive evaluations to the recommended product with primary features (attitude: $M = 4.57$; purchase intention: $M = 3.78$) than with secondary features (attitude: $M = 4.06$; purchase intention: $M = 3.20$; $ps < .001$). Hence, H5 was supported (Figure 3).

For H6, we used Hayes's model 15 (bootstrapping sample size = 5,000; Preacher et al. 2007). The independent variable was a coded perceived similarity to AI agent (anthropomorphized AI agent = −1 and non-anthropomorphized AI agent = 1). The mediation variable was the psychological distance to the AI agent, and the moderator variable was the coded product feature (primary feature = 1, secondary feature = −1). The attitude toward appearance of AI speaker was the covariate variable. The results demonstrated that the conditional indirect effect was statistically significant.

First, perceived similarity to AI agent positively affects the psychological distance ($B = -.42$, $SE = .10$, $p < .001$). For the dependent variables, we did not expect the effects of perceived similarity to AI agent on the product attitude was significant

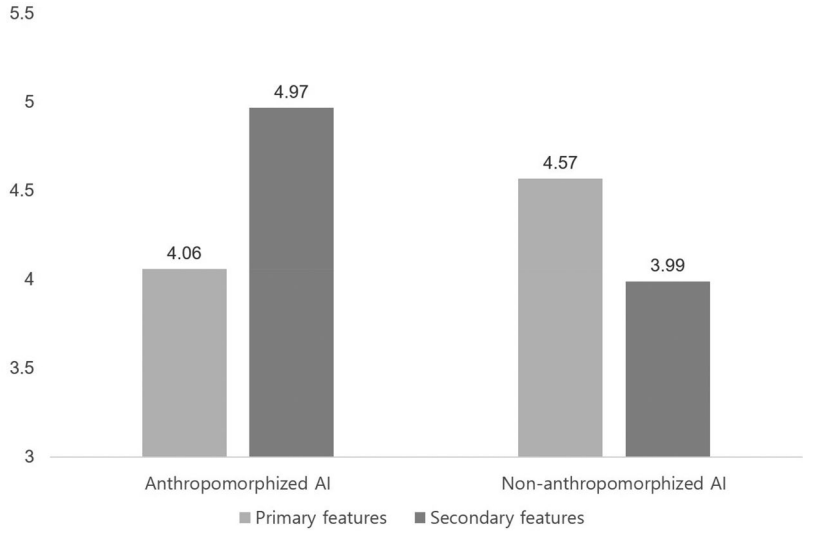

Figure 3. Perceived similarity to agent × product feature on product attitude (Experiment 2).

($B = -.16$, $SE = .05$, $p < .01$). but, in case of purchase intention, the effect of anthropomorphism was not significant ($B = -.11$, $SE = .08$, $p = .174$). More importantly, the interaction effect between perceived similarity to AI agent and product feature was not significant ($B = -.08$, $SE = .05$, $p = 106$), but we found a statistically significant interaction effect between the psychological distance and the product feature ($B = -.73$, $SE = .05$, $p < .001$; 95% CI = −.82 to −.64). The conditional effects were significant in both secondary ($B = .72$, $SE = .06$, $p < .001$; 95% CI = .61 to .84 and primary features condition ($B = -.73$, $SE = .07$, $p < .001$; 95% CI = −.85 to −.59). The same pattern of results was observed for purchase intention. (see Table 2). These findings supported that a message with secondary features of products is more effective when psychologically close to the target, and a message with primary features is more persuasive when psychologically distant to the target. Thus, the results lend support for H6.

General discussion

As AI is being applied to various fields in our day-to-day lives, it is becoming a prospective topic for academic researchers and practitioners. Experts estimate that by 2024, the number of digital voice assistants in use worldwide will reach 8.4 billion units (Vailshery 2021). It is not just the use of smart speakers in online shopping that has now expanded, but also the use of chatbot services, AI, or computer programs with the ability to talk via text as well. By 2024, Insider Intelligence predicts that consumer retail spend via chatbots worldwide will reach $142 billion up from $2.8 billion in 2019 (Insider Intelligence 2021). As such, AI agents have already deeply penetrated our consumer life. However, there is a lack of research on the psychological mechanisms affecting the persuasive effect of communication between AI agents and consumers.

Table 2. Conditional indirect effect of perceived similarity to agent × product feature on product attitudes/purchase intension (Experiment 2).

First Equation: Dependent Variables						
	Product Attitudes			Purchase Intention		
	B	*SE*	*p*	*B*	*SE*	*p*
Perceived similarity (X)	−.10	.08	.227	−.09	.09	.359
Product feature (MO)	−.05	.08	.565	−.03	.09	.741
X × MO	.23	.08	< .01	.30	.09	< .001
AI appearance (CO)	.36	.07	< .001	.25	.08	< .01
Second Equation: Psychological Distance						
	B		*SE*		*p*	
X	-.42		.10		< .001	
CO	.12		.09		.190	
Third Equation: Dependent Variables						
	Product Attitudes			Purchase Intention		
	B	*SE*	*p*	*B*	*SE*	*p*
X	−.16	.05	<.01	−.11	.08	.174
Psychological distance (ME)	.045	.04	.461	.063	.07	.355
MO	2.47	.16	< .001	2.13	.26	< .001
X × MO	−.08	.05	.106	.04	.08	.621
ME × MO	−.728	.05	< .001	−.63	.07	<.001
CO	.07	.04	.118	-.01	.07	.908

The objective of this study was to reveal the effects of psychological distance caused by perceived similarity to AI agents on message persuasion. We demonstrated through two experiments that individuals gauge psychological distance toward AI agents differently because of the different level of perceived similarity to them, and that the effects of persuasion differ depending upon the psychological distance toward AI agents. Comparing human agents to AI agents, Experiment 1 revealed that consumers felt AI agents were psychologically distant from human agents. It further suggested an effective messaging strategy based on psychological distance. In Experiment 2, we manipulated the perceived similarity to AI agents through anthropomorphism and showed that the product attributes preferred by consumers vary depending on the psychological distance toward AI agents.

Theoretical and managerial implications

This study contributes to the literature on several fronts. First, as AI technology has been applied to a variety of products and services, human-AI interactions are already proliferating (Kim et al. 2019; Nass et al. 1997; Nass and Lee 2001). Therefore, the need for the way to increase AI agent's persuasive effect has become very important. Most previous studies centered on the main effects of similarity on interactions with AI (e.g., Nass et al. 1995; Nass and Lee 2001; Duffy 2003; Phillips et al. 2018). In the current study, we found the important role of psychological distance in human-AI interaction by examining the hypothesis that the effect of interaction effect between perceived similarity and message type (product features) on AI agent's persuasion is mediated by psychological distance. Our study sheds light on the psychological

distance between human and AI and suggests that anthropomorphism for AI affects the psychological distance to AI. We extended the results of prior research that showed the psychological distance to an object depends on the individual's perceived similarity to the object and the relationship between consumers and recommendation agents (Liviatan et al. 2008; Tajfel 1982; Triandis and Triandis 1962).

Furthermore, findings of the study contribute to expanding the field of theory by applying the existing CLT (Trope and Liberman 2010) to the AI agent context. In Experiment 1, we verified that among messages that emphasized feasibility and desirability, the effective messages depended on the psychological distance to the recommendation agent (human vs. AI). Additionally, Experiment 2 showed that depending on the degree of anthropomorphism of AI agents, consumer preference for a product's advertisement messages (focus on primary vs. secondary features) appeared differently. It is not just message framing but also an individual's construal level that affects one's attitude, behavior, and even emotion (Trope and Liberman 2010).

From managerial perspective, the results of the study provide meaningful implications for the role of psychological distance in increasing the effectiveness of human-AI interactions and persuasion. In fact, the psychological distance to an AI agent can vary depending on not only its look, but also its social roles and personalities. For example, individuals usually perceive friends psychologically closer than assistants or companions, suggesting that the psychological distance toward AI agents will be varied depending on the social roles of AI. However, despite the positive effects of perceived similarity in human-AI interactions, the threshold of the perceived similarity should be considered as well. As found in previous studies, some individuals feel threatened and fearful when they interact with too much human-like AI agents or robots (The Guardian 2019). Therefore, it is necessary to design the similarity of AI agents to the appropriate extent, depending on the contexts, roles, and interaction partners of the AI agents.

AI agents for consumers are already prevalent in both online and offline stores, and consumers buy a variety of goods, including household items, apparel, electronics, and groceries, through AI agents (Southern 2019). For example, Uniqlo, a world-famous clothing apparel company, recently launched an AI shopping assistant that can provide product rankings by occasion and personal preferences (Wiggers 2018). The findings suggest that the psychological distance to AI varies, and accordingly, an effective communication strategy between consumers and AI agents can be formulated. That is, when marketers attempt to employ AI agents, such as a chatbot or virtual assistant for consumers, they need to consider the psychological distance between consumers and AI agents and provide a proper communication strategy as well as AI manipulation to increase the persuasiveness of AI agents.

Limitations and future research

Although the present study suggested perceived similarity toward AI as antecedent of psychological distance, there are other various affects psychological distance toward AI agent. Thus, future research should investigate the effects of AI's personalities, emotion, and roles on the psychological distance between consumers and AI and their effects on persuasion.

Moreover, for AI to fulfill its function as recommendation agents, the cultural characteristics of individuals must also be considered. Generally, Asian cultures (e.g., Chinese, Korean, Japanese) value hierarchy in interpersonal relations. They feel power distance, which is about social hierarchy when they interact with others. Western cultures, on the other hand, seek horizontal interpersonal relationships (Gudykunst et al. 1996; Nisbett 2004). Given that power distance positively correlates with psychological distance to others (Smith and Trope 2006), Asians may feel more psychologically distant to AI compared to Westerners. Furthermore, individuals from Asian cultures are friendlier and warmer to their inner circle, while individuals from Western cultures are less so (Singelis et al. 1995). If individuals treat AI as their in-group member, such as a friend, then Asians will feel psychologically closer to AI compared to Westerners. Therefore, future research should look at how individuals perceive AI psychologically according to culture and present a corresponding communication strategy.

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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