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The Agreeableness of a Virtual Agent: Effects of Reciprocity and Timing of Help

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***Abstract*—The virtual agent's agreeableness has been highlighted with the increasing importance of social interaction with intelligent agents. As a virtual assistant, the agents are perceived as agreeable by users with their support of help and cooperation. Considering the context-dependent nature of human-agent interaction, it is important to examine the situational variables in defining an agent's behavior as a predictor of agreeableness. In this regard, our study conducted 2 (help type: reciprocated *vs.* unreciprocated) x 2 (timing of help: wanted *vs.* unwanted) between-subjects design to analyze the effect of agent's reciprocity of help as well as its timing of whether the recipients want help or not. Our results show that an intelligent agent giving unreciprocated help was perceived as much agreeable and socially attractive than an agent showing reciprocated help. Also, the recipient's unwanted help damaged users' perception of the agent's agreeableness and social attraction. These findings have both theoretical and practical implications.**

***Index Terms*—Virtual Agent, CASA, Agent personality, Reciprocity norm, Social attraction**

I. Introduction

Virtual agents are artificial intelligent artifacts that mimic natural conversations (i.e. text or speech) and nonverbal behaviors of humans [1]. The importance of social interaction with virtual agents has been highlighted in various fields such as health, learning, commerce, therapy, video games, and military systems [2]. In each field, the agents help users by providing information or services based on users' needs. These socially intelligent agents are regarded as a human-like interactant, as it is expected to have social features to support human tasks. According to the Computers-Are-Social-Actors (CASA) paradigm [3], humans tend to mindlessly apply social rules in human-computer interaction. Therefore, social rules people perceive appropriate and thus conform to in social situations is also reflected in the human-agent interaction.

One of the key traits required to virtual agents as a social interactant is forming an impression of agreeableness—one of the "Big Five traits" that describe the personality dimensions [4]—to give friendly and sociable feelings. Agreeableness is a key disposition that gives pleasure and conformation in social interaction [5]. It is supported by the fact that a mere presence of at least one agreeable member in the dyad results in higher rapport perceived with a conversational partner [6]. The perception of agreeableness is strongly related to prosocial behaviors, which is defined as voluntary behaviors intended to benefit another. Prosocial behaviors such as helping others are explained by several traits, such as "generous", "kind", "helpful", and "considerate", all of which overlap with agreeableness [5] [7]. As people are willing to draw inferences about personal characteristics of others based on limited information, impressions of others primarily stem from what they behave or their "expressive behaviors" [8]. Thus, the agent's helping or cooperation can form one's perception of other's personalities regarding agreeableness.

Although the agent's agreeableness can be inferred from its helping behaviors as a dispositional factor, a wide range of studies have reviewed that situational factors are also crucial to displaying its behavior. While previous studies have implemented an agent's personality in the respect of linguistic cues on textual content (e.g. [9] [10]), voice parameters (e.g. [11]), and nonverbal behaviors (e.g. [12]), few studies have considered the situational factors (e.g. severity of need, cost of helping) that are highly influential in interpreting agent's helping behavior as a sign of agreeableness. As human behavior is an outcome that complicates various psychological constructs, a precisely defined context of human-agent interaction is needed to describe the appropriate situation in which the agent's helping behaviors are perceived as agreeable. Also, concerning the fact that such prosocial behavior can be implemented regardless of whether the behavior is motivated by altruism (e.g. sympathy, moral reasoning, and perspective-taking) or a baser form of motivation (e.g. external rewards and social approval) [13], the agent's helping can be perceived either sincere or not. If the agent's helping behavior appears to be triggered by non-altruistic motive, it will not be considered as good.

In the current study, we investigate contextual conditions in which expressive behavior can induce users to have a strong perception of agreeableness regarding the sociable agent. It is a novel attempt to consider behavioral contexts of agents and examine how these contextual factors cause prosocial behaviors to be inferred as certain type of personality, agree-

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ableness. Furthermore, we have assessed the users' responses under a specific situation in which the human-agent interaction is embedded. This attempt gives implications to personality research focusing on the perspective of agreeableness which is socially desirable in human interaction. Our study also defines matching attributes of agent personality with the context providing efficient cues on the human-agent interaction presenting limited cues. It establishes a practical guideline on the design of a virtual agent and expands discussion of personality traits that lead to a perceptual impact of sociable agents.

II. Related Work

A. Personality traits applied to virtual agents

Personality is a pattern of behavioral, temperamental, emotional, and mental traits that makes difference of people from one another. It consists of a structured and dynamic set of characteristics held by an individual affecting his or her behavior, cognition, and motivation in different circumstances [14]. As how a person perceives, acts, and reacts are influenced by his or her personality, a significant relationship exists between personality and human response or behavioral outcomes. Human personality is related to successful job performance [15] and influence learning attitudes determining learning performance [16] [17] [18]. Also, personality has an impact as a predictor of positive health behaviors [19] [20], increased longevity [21] as well as poor health outcomes including all-cause mortality [22].

Based on the effects of personality on human perceptions, many studies have reviewed the personality of virtual agents and emphasized the relationship between agent personality and users' responses toward the agent. Although computer agents might not have a "real" personality in the ontological sense, it can be psychologically real as users respond to computer personality in the same way that they would respond to human personality [23]. As a result, the evident trend in social psychology studies transfer to human-agent interaction as well. For instance, Moon and Nass [10] discovered that the similarity-attraction rule is applied to interactive agents in which similar-personality agents were rated higher in agent likability, competence, and satisfaction. Also, the consistency of personality is preferred in the interaction with the agent as well as the human interactant [12].

B. Agreeableness desired in social interaction

Among a large number of personality models proposed, the Big Five traits have been widely accepted. The Big Five represents a taxonomy of traits that capture the essence of individual differences in personality [24] including Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Among the dimensions, many studies have shown how agreeableness has been recognized to have a major impact on human attitudes [25]. Of all of the Big Five dimensions, agreeableness and extraversion are the best predictors of the outcomes and processes about peer relationship among children, such as peer acceptance and friendship [26]. Specifically, low agreeableness and low extraversion are associated with rejected peer status [27].

Graziano and Eisenberg [5] declares that agreeableness might have evolved as an important dimension in determining an individual's value to a group. During a long period of human evolution, a certain individual difference that promotes the survival of the group became essential attributes in living and gathering in social groups. As we are group-living creatures, who cooperate extensively, help others, and conform to and enforce social norms, human has been termed as "prosocial", which leads to benefiting others or positive interest in others' welfare [28] [29] [30]. Agreeableness is strongly correlated with self-reports of prosociality [31] and volunteering [32]. Thus, an individual's prosocial behavior can express his or her sociable aspects of personality, which implies agreeableness [33] [34].

Batson and Powell [35] articulated prosocial behavior as the broad range of actions intended to benefit one or more people other than oneself such as helping, comforting, sharing, and cooperation. According to their research, prosocial behavior consists of two types of factors: dispositional and situational. The dispositional variables—autonomy, deference, intelligence, nurturance, religiosity, self-esteem, social desirability, social responsibility, and submissiveness— are unclear and less decisive, while situational factors—ambiguity of need, severity of need, physical appearance of victim, similarity to victim, friendship, number of bystanders, location (urban vs. rural), and cost of helping—seemed powerful and thus making a behavior to be perceived prosocial. Situational variables are regarded as critical predictors of prosocial behavior than are dispositional variables. Doris [36] reviewed more than 150 studies of spontaneous helping behavior and concluded that behavioral regularity is more likely to be explained by situational regularity. He stressed that neither personality nor character trait itself can explain the motivation of helping behavior as long as the situational factors fluctuate.

C. Reciprocity rule of help

The significance of the situational factor implies that prosocial behaviors vary with the status of participants within a society. It influences human behaviors that follow the social norm of reciprocity. Reciprocity influences our behavior when we sense a moral obligation to return a favor [37]. This internal reciprocity encourages us to repay a debt not because people expect us to, but because we want to reward a particular behavior. Also, this reciprocated exchange is mediated by gratitude, a positive emotion that is essential for building social relationships [38]. In this sense, people who receive benefits from other's helping behavior tend to display prosocial responding (i.e.gratitude) through the norm of reciprocity.

Gouldner [39] states that the pressure on a person to comply with the norm of reciprocity depends on two situational

factors: (a) one's perception of the other person's motives for help; (b) how desirable the given help was. Regarding the first factor, there is an unreciprocated help that is activated by altruism. Altruism is the motivation to increase another person's welfare, which is contrasted to egoism, the motivation to increase one's own welfare [40]. McAndrew [41] proposes that unreciprocated helping may provide information to others about the benefactors that will enhance perceptions of their reputation and status within the group as people who have considerable resources can only provide such "generous" behaviors. Therefore, altruistic help might motivate the help-recipients to perceive a strong impression of agreeableness, which may leads to positive attitude toward the benefactors. In this sense, the virtual agent's altruistic behavior would induce positive response to a greater extent, when the behavior is unreciprocated.

Hypothesis 1a. An agent that gives unreciprocated help will evoke a higher perception of agreeableness than the agent which follows the norm of reciprocity.

Hypothesis 1b. An agent that gives unreciprocated help will evoke higher likability than the agent which follows the norm of reciprocity.

Hypothesis 1c. An agent that gives unreciprocated help will evoke higher social attraction than the agent which follows the norm of reciprocity.

The second factor, desire for help, also makes difference in the perception of someone's helping behavior. According to Bartlett and DeSteno [38], "gratitude functions to encourage an individual to reciprocate a favor", whenever they receive help from others. Yet, the emotion of gratitude is sensitive to the cost and benefit associated with altruistic acts [42]. In this sense, we can expect that helping motivated by both altruism and reciprocity norms would be beneficial for people who need help, while the level of gratitude would be slightly higher in altruistic helping.

On the other hand, for those either who do not ask for help or do not need help, supportive interaction may be negatively perceived. Previous studies declare that receiving social supports emphasizes two underlying factors: how the other's action is interpreted (e.g. [43] [44]) and how support is offered within social relationships (e.g. [45] [46]). Unsolicited support or advice is likely to be interpreted as unpleasant because the support was perceived as interference or an indicator that the recipient was judged to be incompetent [47]. In this respect, the agent's help which is not desirable by the recipient will be perceived as more negative than the help which is wanted. Besides, people who need or do not need help would like to receive unreciprocated help more than reciprocated help that requires rewards as a return.

Hypothesis 2a. Recipients who receive wanted help will have a higher perception of agreeableness on the agent than those who receive unwanted help.

Hypothesis 2b. Recipients who receive wanted help will have higher likability on the agent than those who receive unwanted help.

Hypothesis 2c. Recipients who receive wanted help will have a higher social attraction on the agent than those who receive unwanted help.

III. Method

A. Overview

The experiment employs a 2 x 2 factorial design in which "agent's reciprocity" (reciprocated help or unreciprocated help) and "timing of help" (wanted or unwanted) vary into two conditions respectively. Participants had an interaction with a virtual agent via an online platform for 10 minutes. The agent provided three different quizzes and gave hints depending on the timing whether the participants needed or not. Also, the agent's help type was manipulated either reciprocated or unreciprocated: in the reciprocated help condition, the agent required the participant to provide personal information, while the agent in the unreciprocated help condition did not. After finishing an interaction with the agent, participants responded to a survey questionnaire that is about the agent's perceived agreeableness, likability, and social attraction.

B. Participants

In the study, 41 college students from a private university in Korea were recruited. All of them can read Korean and have no disability of using the materials for the experiment. Among them, 17 participants who were not manipulated in each of the conditions were excluded from the analysis (see E. Measures below for details). As a result, 24 participants (20 females and 20 males) were used to report the results of the experiment.

C. Procedure

The experiment was implemented in the form of an online survey so that participants who have access to the online link can participate. We have created a virtual agent named "Kira" as a social interactant in the online interaction. The interaction with Kira proceeds with three steps: Kira provided a quiz; asked users their need for help; and gave a hint for each quiz.

First, the agent introduced itself and provided a quiz at a difficult or easy level depending on the condition. In the wanted help condition, a quiz was given at a difficult level without providing any clue to solve the quiz (e.g. "Complete one meaningful word with these scattered letters: [ㅈ, ㅏ, ㄹ, ㅜ, ㅁ, ㅏ, ㄷ, ㅣ]"). On the other hand, in the unwanted help condition, the same quiz was given at an easy level suggested with several clues about the answer (e.g. "Which animal can be completed by collecting these letters? It is small, lives in a tree, and likes to eat acorn: [ㄷ, ㅏ, ㄹ, ㅜ, ㅁ, ㅏ, ㅈ, ㅣ]").

The order of the letters was differently manipulated to make people feel difficult (or easy) to solve the quiz, and therefore, determine their need (or no need) for help. In this way, the participant's need for help was manipulated, and the effect was measured by self-reporting questions as a manipulation check (see details in Measures section).

Next, the agent provided a hint that facilitates participants to solve the quiz. Before giving a hint, participants were asked if they want help from the agent to solve the quiz. However, the hint was given to all participants regardless of whether they reported they need (wanted condition) or not need (unwanted condition) help. The type of hint was manipulated in two different aspects: In the reciprocated help condition, participants were asked to provide personal information (e.g. the participant's wake-up time, the color of the clothes that the participant is wearing, participant's recently purchased product) as a return of the agent's help. In contrast, the agent in the unreciprocated help condition gave hints without requiring participants to reveal any personal information.

Three quizzes and hints were provided alternately. After they interacted with the agent, participants responded to questionnaires regarding the agent's perceived agreeableness, likability, and social attraction.

D. Material

We brought the quiz materials from "Problematic Men", the Korean TV quiz show in which various types of cognitive ability tests were discussed, broadcasted on tvN from 2015. In the experiment, three quizzes were provided: matching a random set of letters to complete one meaningful word; finding a pattern between numbers and alphabets suggested in a particular way; predicting a number to come next based on the preordered list of numbers.

E. Measures

We measured perceived agreeableness, likability, and social attraction toward the agent "Kira" as the dependent variables.

a) Perceived agreeableness: The NEO Personality Inventory (NEO-PI) [48] is a 30-item questionnaire developed to measure the five-factor model of personality. Among the facets, agreeableness can be assessed using six items: trust, straightforwardness, altruism, compliance, modesty, and tender-mindedness. Participants' perceived agreeableness toward the virtual agent was rated on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree) (α=.622).

b) Likability: We asked participants to evaluate the virtual agent in terms of perceived likability according to a four-item likability scale [49]. Participants responded to four sets of adjectives (i.e. friendly, understanding, likable, and respectable) using a 7-point scale (α=.792).

c) Social attraction: Social attraction has been measured as one of the subscales of interpersonal attraction construct [50]. Four items were used to measure social attraction of social agent: "someone who is difficult to talk with and get to know"; "A person that I could never establish a personal friendship with"; "A friend of mine"; "A person that just would not fit into my circle of friends". 7 point Likert-type scales were selected as the measurement social attraction (1 = "strongly disagree", 7 = "strongly agree") (α=.576).

To check whether our manipulation of need of help was successful, we provided two questions. After providing a quiz, we asked "do you want to receive a clue to solve this quiz?"; after providing a clue regardless of their answer to the first question, we also asked, "did you use the provided clue to solve the quiz?" In the wanted help condition, participants were expected to answer 'yes' to all of the manipulation check questions, while those allocated in the unwanted help condition were expected to answer 'no' to the same questions. Participants who answered in an unexpected way (i.e. answering 'no' to both of the questions, answering 'yes' to the first question and 'no' to the second question, or vice versa) were all excluded from the analysis of the experiment result.

IV. Result

We used MANOVA to test the hypotheses for each independent variable. The main effect of the agent's reciprocity was marginally significant on agreeableness showing unreciprocated agent (M=4.38, SD=.69) is evaluated higher on than reciprocated agent (M=3.88, SD=.78), [$F(1,20)$=3.14, $p<.1$]. Thus, H1a was not supported. The agent's reciprocity was not significantly influential to its perceived likability [$F(1,20)$=.55, *n,s.*]. Thus, H1b was not supported. However, the unreciprocated agent's social attraction [M=3.91, SD=.74] was higher than the reciprocated agent's one [M=2.93, SD=1.04], $F(1,20)$=.13.65, $p<.001$. Therefore, this result lends support for H1c.

The main effect of the recipient's need was significant both on agreeableness. H2a was confirmed revealing that the participants who received wanted help (M=4.44, SD=.55) perceive higher agreeableness than the recipient who received unwanted help (M=3.83, SD=.85), [$F(1,20)$=4.69, $p<.05$]. H2c was also confirmed proving that participants who received wanted help (M=4.06, SD=.69) perceive higher social attraction than participants who receive unwanted help (M=2.79, SD=.9), [$F(1,20)$=4.69, $p<.001$]. On the other hand, H2b was not supported showing an insignificant difference of likability between the recipients of wanted help (M=4.27, SD=.72) and the recipients of unwanted help (M=3.52, SD=1.32), [$F(1,20)$=2.77, *n,s.*]. The interaction effect between the agent's reciprocity and recipient's need was not founded.

V. Conclusion

The results marginally supported H1a, while significantly confirmed H1c, H2a, and H2c. It shows that both the agent's reciprocity of help and the user's need for help is important in

the perception of the agent's agreeableness and social attraction. Even when the virtual agent helps users, if the help is reciprocated, users perceive the agent as disagreeable and less attractive as a social interactant. Also, the results confirm that users' need for help affects their perception toward the agent as unwanted help is less favorable and pleasant. Contrasted to the perceived agreeableness and social attraction, the agent's likability is not influenced by both agent's reciprocity and the user's need for help.

VI. Discussion

One of the key findings in the current study is that a mere presentation of help cannot confirm the presenter's agreeableness or social attraction. Evolutionarily prosocial acts have been preferred in social interaction and the aforementioned literature also points out the strong link between perceived agreeableness and prosocial behaviors. Yet, this link is not immutable; we have to consider the context in which the prosociality is demonstrated.

Our study reveals that the agent's conditional help that requires any type of return from users might damage its social impression. As people mindlessly perceive the computer agent as a social being, they expect to see it behaves in a polite way [3]. Thus, even in the interaction with a virtual agent, individuals tend to expect altruistic help from the friendly computer interactant. It becomes of greater importance as computers get smarter; intelligent computer agents can not only process complex tasks that instructed by human users, but also perform social tasks, assisting users as an instructor, tutor, health trainer, time manager, or even as a friend to chat with. The more tasks a virtual agent can do for users, the more information is required from users. For instance, web personalization can customize users' experience by reflecting their preference and usage patterns rather than providing a broad and simple experience others might have as well. However, this tailored service is based on the user's data. Even though it seems that the computer system does not explicitly demand users' data, there is always a tradeoff between user benefits and requirements. Although a helping agent aims to benefit users, they would perceive the agent as socially unattractive and intend not to use it anymore, if they were asked to perform the further deed for the agent.

Another noteworthy finding in the study is that the timing of a virtual agent assistance matters. It affects the impression of the agent that gives help. As we have reviewed, unwanted help can negatively intervene with users. The reactance theory explains more about the user's negative reaction toward helping which poses an implicit restriction on the recipient's freedom for future action [51]. It is more essential in the learning context, as people who have a high motivation for achievement perceive helps as negative [52]. Considering users' characteristics as well as the context is important even in displaying prosocial behavior which seems always positive and grateful.

The current study has theoretical implications in that agreeableness is not readily perceived and assessed especially when the observations are small (e.g. [53] [54]). Nevertheless, our study proved the significance of the agent's agreeableness regarding the motivation of the agent's help and users' need for help. Furthermore, we provided how to increase social attraction in the context of human-agent interaction. Helping itself is beneficial and favorable for humans in social interaction. However, for a computer agent that is constructed and designed for helping users, it is not easy to be perceived as socially attractive, which can lead to an intimate relationship. Making a friendly computing agent is one of the primary goals of interface designers and user experience professionals. Thus, the current study presents a practical contribution to the field as well.

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