Communication Research OnlineFirst, published on February 10, 2010 as doi:10.1177/0093650209356389

Communication Research
XX(X) 1–24

DOI: 10.1177/0093650209356389
http://crx.sagepub.com
SAGE

What Triggers Social Responses to Flattering Computers? Experimental Tests of Anthropomorphism and Mindlessness Explanations

Eun-Ju Lee[1]

Abstract

The present research evaluated two explanations for the *computers are social actors* (CASA) paradigm: anthropomorphism and mindlessness. Using flattery effects as an example of social responses, two experiments examined how humanlikeness of the interface, individuals' rationality, and cognitive busyness moderate the extent to which people apply social attributes to computers. In Experiment 1, anthropomorphic cartoon characters elicited more positive overall evaluations of the computer, but they significantly reduced low rationals' self-confidence, suggesting social facilitation effects. Moreover, low rationals were less likely to accept the computer's suggestions when flattered, whereas high rationals showed no corresponding tendency. In Experiment 2, although participants attributed greater social attractiveness to the flattering than generic-comment computer, they became more suspicious about the validity of its claims and more likely to dismiss its answer. Such negative effects, however, disappeared when they simultaneously engaged in a secondary task. Theoretical implications for CASA are discussed.

Keywords

anthropomorphism, computers are social actors (CASA), flattery, human-computer interaction (HCI), mindlessness

In a series of studies based on a research paradigm called *computers are social actors* (CASA), Nass and his colleagues have demonstrated that people tend to make social attributions to computers and evince the same responses to computers as they would to human

[1]Seoul National University, Seoul, Republic of Korea

Corresponding Author:
Eun-Ju Lee, Department of Communication, Seoul National University, San 56-1 Shilim-Dong, Gwanak-Gu, Seoul, 151-742, Republic of Korea
Email: eunju0204@snu.ac.kr

interactants (Nass & Brave, 2005; Reeves & Nass, 1996). For example, Nass, Moon, and Green (1997) found that study participants rated male-voiced computers as more proficient in technical subjects than female-voiced ones, whereas the opposite was true for topics such as love and relationships. Similarly, people not only inferred a computer's personality from verbal (e.g., assertive vs. tentative language) or paraverbal cues (e.g., pitch, speech rate) embedded in the interface but they also responded more positively to computers whose personalities matched their own (Moon & Nass, 1996; Nass & Lee, 2001).

Even when a computer does not embody such uniquely human traits, people often seem to spontaneously apply social heuristics to the lifeless machine. For example, when the computer first provided some information about its technical capacity, participants reciprocated such self-disclosure with more intimate responses to the computer's questions than when the computer simply asked the same questions (Moon, 2000). Another instantiation of social responses to computers pertains to flattery effects. Specifically, Fogg and Nass (1997) told participants that the computer's evaluations were generated randomly and thus not diagnostic of the actual quality of their performance. When the computer praised their performance, such meaningless comments nonetheless elicited the same positive reactions as did sincere praise, the positive feedback ostensibly contingent on their input. That is, when the computer flattered, participants rated the interaction more favorably, thought they performed better, and evaluated the computer more positively than when the computer provided generic feedback.

Although a large volume of research has repeatedly documented the persistence of various social rules in human-computer interaction (HCI), a reasonable explanation or even clear boundary conditions for such findings remain elusive. To move beyond simple replications of social rules in HCI, the current research evaluated two potential explanations for why people apply social heuristics toward computers: anthropomorphism and mindlessness. Specifically, using the aforementioned flattery effects (Fogg & Nass, 1997) as an example of social responses, the present experiments investigated how (a) the degree of human likeness of the interface, (b) the individual's proclivity to engage in analytical thinking (i.e., rationality), and (c) situational demand for cognitive resources might affect the ways in which people respond to blatantly placebic praise from the computer. By incorporating rationality, the current research not only evaluated whether there are stable individual differences in the general tendency to treat computers as social actors but it also examined how individual differences interact with the technical features of the interface to produce social responses, a largely overlooked area in the extant CASA literature.

Anthropomorphism Versus Mindlessness Explanations for CASA

According to the CASA paradigm, the tendency to anthropomorphize computers is more or less automatically activated. Other researchers, however, have systematically varied the extent to which an interface resembles human, either in its form or functionality, and examined how such variations affect user responses. In Sproull, Subramani, Kiesler, and Walker's (1996) study, for example, people responded to an ostensible computer-based career counseling system that employed either simple text display or a talking face, one of the clearest human referents. Participants reported greater arousal and displayed a stronger social desirability bias in the talking-face condition, presumably because “the talking-face display reminded subjects of a real human being” (Sproull et al., 1996, p. 117). In a follow-up study, participants played a social dilemma game with a human confederate via video-conferencing or with one of three interface agents: a person-like agent, a dog-like agent, or a cartoon dog agent. The anthropomorphic agent induced greater cooperation, on a par with a human partner, although the dog-like agent was considered as more likeable (Parise, Kiesler, Sproull, & Waters, 1999).

Other studies have employed a more sophisticated rendition of humanlike computer agents. Specifically, Bailenson, Blascovich, Beall, and Loomis (2001) examined how embodied computer agents’ nonverbal behavior affects the interpersonal distance people maintain in the immersive virtual reality environment. Results showed that when the virtual human displayed realistic gaze, people increased interpersonal distance to ensure an optimal level of immediacy. Similarly, Cassell and Thorisson (1999) compared two different kinds of nonverbal behaviors of embodied computer agents, envelope feedback (i.e., those related to the process of conversation, such as nods, gaze, and head movements), and emotional feedback (i.e., facial displays referencing emotions, such as happiness and puzzlement). They found that envelope feedback elicited more positive evaluations of the interaction and led people to use fewer utterances to complete the task.

Analogous to the research on anthropomorphic computer interfaces, Hinds, Roberts, and Jones (2004) investigated how the humanlike appearance of professional service robots (e.g., facial features, arms and legs, human clothing) affects the working relationship, in conjunction with the status manipulation (subordinate vs. peer vs. supervisor). Considering that “participants retained more responsibility for the successful completion of the task when working with a machine-like as compared with a humanoid robot, especially when the machine-like robot was subordinate” (Hinds et al., 2004, p. 153), anthropomorphic appearance seems to play a significant role in establishing partnership in human-robot interaction. Likewise, when human likeness was manipulated in the form of the robotic dog’s ability to learn new behaviors over time (Lee, Park, & Song, 2005), it evoked more positive perceptions and facilitated the formation of a stronger bond.

Although these studies suggest that humanlike representations evoke different affective reactions from users, few have attempted to link the anthropomorphic qualities of the interface to social responses to computers. That is, researchers evaluated how anthropomorphic interfaces compare to their non- or less-anthropomorphic counterparts, in terms of liking, communication behavior, and task performance, but not of the likelihood of social treatment of the computer. To fill this void, the present study systematically varied the degree of humanness manifested in the computer output and examined its effects on the extent to which people display previously documented flattery effects.

Another explanation for CASA pertains to mindlessness. Based on Langer and her colleagues’ work (see Langer, 1989, 1992, for reviews), Nass and Moon (2000) argued that when a computer emulates humanlike attributes, such as interactivity and voice, people tend to focus on such cues and fail to take into account the asocial nature of the interaction.

Consequently, despite their awareness that it is inappropriate to apply social expectations to computers, they come to mindlessly use social categories for computers (e.g., gender) and emit overlearned social behaviors (e.g., reciprocity).

In fact, some researchers have attempted to examine the supposed link between mindlessness and social treatment of computers. For example, Johnson, Gardner, and Wiles (2004) found that flattery effects were more pronounced among those with more, not less, computing experience. Specifically, experienced computer users reported more positive feelings and judged the computer's performance more favorably in response to flattering than generic comments from the computer, whereas those with less computing experience did not show the corresponding tendency. Just as practice leads to overlearning and increases the likelihood of mindless reactions (Langer & Imber, 1979), greater computing experience appeared to prompt people to "mindlessly apply human schemas and expectations to computers" and respond to computers "based on inappropriate cues inherent in the task" (Johnson et al., 2004, p. 242). Although the results seem to support the notion that mindlessness fosters social responses to computers, mindlessness was not directly measured but merely inferred from the level of computer experience. To address this issue, Experiment 1 measured individuals' overall proclivity to engage in analytical thinking (i.e., rationality) as an index of chronic mindfulness and examined how it moderates the effects of flattery from a computer. In Experiment 2, mindlessness was experimentally manipulated by systematically varying the number of tasks participants simultaneously engaged in.

Experiment 1

According to cognitive-experiential self-theory (CEST; Epstein, 1994; Epstein & Pacini, 1999), there exist two different information processing systems, experiential and rational, which represent intuitive and analytical modes of information processing, respectively. The experiential system is a preconscious system that operates in a manner that is automatic, concrete, holistic, primarily nonverbal, and intimately associated with affect. By contrast, the rational system is a conscious system that is analytical, intentional, effortful, primarily verbal, affect free, and highly demanding of cognitive resources (Pacini & Epstein, 1999). Just as systematic or central processing entails a relatively analytic and comprehensive treatment of judgment-relevant information (Chen & Chaiken, 1999; Petty & Cacioppo, 1986), the rational system involves highly effortful cognitive activities. Likewise, the experiential system resembles heuristic or peripheral processing as it operates according to heuristic principles and makes minimal cognitive demands on the message processor (Epstein & Pacini, 1999). What distinguishes CEST from other dual-process theories, however, is that CEST assumes that rational and experiential thinking styles are enduring dispositions that lead individuals to attend to and process information in different ways. In this sense, CEST is "a broad personality theory" that highlights "individual differences in degree of heuristic and analytical processing" (Epstein & Pacini, 1999, p. 479).

If flattery from a computer elicits more positive user responses due to mindlessness (Nass & Moon, 2000), and if mindless behavior is more likely to occur when people are less motivated (Langer, Blank, & Chanowitz, 1978; Pollock, Smith, Knowles, & Bruce, 1998) or less able to carefully process and integrate all relevant information (Dolinski, Ciszek, Godlewski, & Zawadski, 2002; Langer & Weinman, 1981), flattery effects should be less pronounced among those who are chronically motivated and better able to perform cognitively demanding activities (i.e., high rationals). In fact, some recent studies have established the connection between rationality and mindful information processing. For example, when presented with threatening information (anthrax death), high rationals were more likely than lows to utilize context-expanding information (traffic deaths) to reduce their apprehension to the focal threat (Berger, Johnson, & Lee, 2003). Likewise, when asked to spontaneously generate explanations for negative trends (e.g., increasing bike theft), high rationals were more likely than lows to invoke a base-rate account (e.g., population increase) to explain away threatening trends (Berger, Lee, & Johnson, 2003; Experiment 2). Considering that mindfulness entails consideration of qualifying conditions that would make threatening information less applicable to information processors themselves (Chanowitz & Langer, 1981), as well as active awareness of alternative conceptions of social stimuli (Langer, 1989), high rationals' reactions to threatening information seem to exemplify mindful information processing. Therefore, to investigate whether mindlessness underlies social responses to computers, Experiment 1 examined how rational thinking style moderates the previously documented flattery effects in HCI.

To assess the anthropomorphism explanation, humanness of the interface was manipulated by showing either simple text messages or adding to them anthropomorphic cartoon characters commonly used to represent human participants in various virtual interactions (see Figure 1). If anthropomorphism accounts for social responses to computers, people would display greater flattery effects when cartoon characters are present than when they are not.

Hypotheses 1a-1b (H1a-1b): Participants will perceive flattering computers as more socially attractive and more believable than the ones producing generic feedback. Such effects, however, will be more pronounced (a) when an anthropomorphic cartoon character represents the computer than when simple text is used and (b) among low rationals than highs.

Hypotheses 2a-2b (H2a-2b): Participants will evaluate their own performance more positively when the computer provides flattering than generic feedback. Such a tendency, however, will be more pronounced (a) when an anthropomorphic cartoon character represents the computer than when simple text is used and (b) among low rationals than highs.

In addition, the present research extended the original flattery study in two important respects. First, this study measured behavioral responses to the computer in terms of conformity. Specifically, participants played a trivia game with the computer. On critical trials, the computer claimed that the participant had picked a wrong answer and suggested a different one. Will the participants' acceptance of the computer's suggestions vary as a function of the meaningless comments (flattery vs. generic comments), despite their knowledge

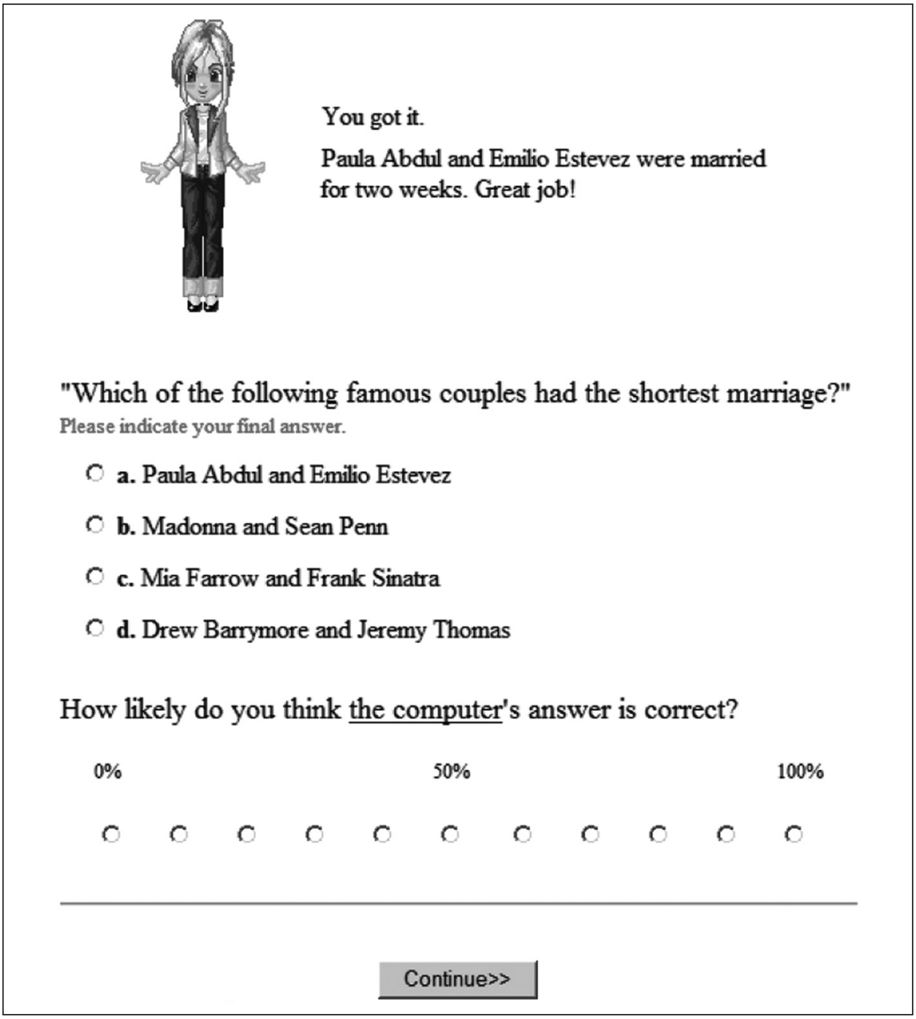

Figure 1. Screen snapshot of text-plus-character condition: Female character

that the comments were randomly generated? Second, such conformity decisions posed a dilemma by forcing participants to choose between their initial pick and the computer's suggestion. Possibly, when the computer praised their performance on previous trials, flattery-induced positive feelings about the computer might make participants more willing to accept the computer's answers, as liking increases persuasive power of the influence agent (Eagly & Chaiken, 1975). Alternatively, if positive feedback from the computer boosts the participants' self-confidence (Fogg & Nass, 1997), it might make them less susceptible to any influence attempts. By creating a situation in which individuals' self-evaluations and the evaluations of the computer are at odds, the current research attempted to capture potentially divergent affective and behavioral effects of flattery from a computer.

> *Research Question 1a-1b (RQ1a-1b):* How will (a) the presence of anthropomorphic characters and (b) the individual's rationality moderate the effects of flattery on the acceptance of the computer's suggestions?

Method

Participants. A total of 204 undergraduate students (130 women and 74 men) enrolled in communication courses participated in the study for extra course credit. They participated in a 2 (Computer comments: Flattery vs. Generic comments) × 2 (Dichotomized rationality: High vs. Low) × 2 (Output format: Text vs. Text plus cartoon character) between-subjects design experiment.

Procedure. Upon arrival at the laboratory, participants were told that they would play an interactive trivia game with a computer. To enhance a sense of interactivity, they were first asked to choose a number, ranging from 1 to 10, to determine a set of questions. In actuality, the computer prompted the same questions irrespective of the number selected. The computer then asked a multiple-choice trivia question (e.g., "Which of the following famous couples had the shortest marriage?"). Once the participants picked their initial answer and moved to the next page, the computer gave its answer, which was presented in written text either with or without a humanlike cartoon character (e.g., "Sorry, the correct answer is D. Drew Barrymore and Jeremy Thomas were married for two weeks."). Those in the character condition saw a human-looking cartoon character, randomly selected out of two male and two female characters.

On five critical trials, the computer suggested a different answer from the participant's. Because participants were explicitly told that the computer was programmed to generate a random answer, their main task was to guess whether the computer was presenting the correct answer and determine their final answer accordingly. On seven filler trials, the computer validated participants' initial answer, providing either generic or flattering comments. Generic comments had neither positive nor negative valence and simply conveyed factual information (e.g., "That's right. Spain gave women the right to vote in 1893."). In addition to this factual feedback, those in the flattery condition received praising remarks, such as "Excellent job!" or "Your trivia knowledge is quite exceptional!"

To enhance their involvement in the experiment and discourage blind rejection of the computer's answer, a US$20 cash prize was offered for the person with the highest score. Thus, to maximize the likelihood of winning the prize, participants had to accept the computer's answer when it seemed like a correct one. Once they submitted their final answer, the computer proceeded to the next question without revealing the real answer. This procedure was repeated for 12 different questions.

Results

Manipulation check. To establish if the addition of cartoon characters indeed rendered the computer more humanlike, participants were asked to rate the computer they interacted with on 10-point semantic differential scales: unnatural/natural, machinelike/humanlike, artificial/lifelike (Powers & Kiesler, 2006). The ratings were then summed to yield the anthropomorphism index (α = .71, *M* = 13.61, *SD* = 5.37). A one-way ANOVA showed a significant main effect for output format, $F(1, 201) = 5.13$, $p = .007$, $\eta_p^2 = .05$. Post hoc tests further confirmed that both female (*M* = 14.57, *SD* = 5.29) and male cartoon characters (*M* = 14.48, *SD* = 5.26) induced stronger feelings of anthropomorphism, as compared to the simple text output (*M* = 12.09, *SD* = 5.26), $p = .02$ and $p = .03$, respectively. There was virtually no difference between the male- and female-character conditions, $p = .99$.

Index construction. For social attractiveness and believability indices, participants were presented with a list of adjectives on a posttest questionnaire. They indicated how well each word described the computer they interacted with on a 10-point scale (1 = *describes very poorly*, 10 = *describes very well*). A factor analysis yielded a two-factor solution that accounted for 77.54% of the original variance. The first factor, which represented perceived social attractiveness, consisted of likable, sociable, friendly, and personal (Eigenvalue = 4.16, α = .88). The ratings were then summed across these four items (*M* = 20.68, *SD* = 8.80). The second factor captured perceived believability, comprised of the remaining three items: trustworthy, reliable, and honest (Eigenvalue = 1.27, α = .88, *M* = 12.26, *SD* = 5.99).

Participants' self-evaluations were measured by asking how confident they were about their initial answer on an 11-point scale before seeing the computer's feedback, which ranged from 0% to 100% in 10% increments. The ratings were averaged across five critical trials (α =.85, *M* = 31.19, *SD* = 20.94).

Conformity was measured by counting how many times, out of the five questions for which the computer suggested a different answer, participants switched to the computer's answer. Conformity score ranged from 0 to 5 (*M* = 2.56, *SD* = 1.47). After choosing the final answer for each question, participants also estimated how likely the computer had presented the correct answer on an 11-point scale, ranging from 0% to 100% in 10% increments. The ratings were then averaged to yield the index for perceived validity of the computer feedback (α = .80, *M* = 42.53, *SD* = 17.87).

Rationality was measured by the short version of Rational-Experiential Inventory (REI; Pacini & Epstein, 1999). Items capture both self-reported ability to think logically and analytically (e.g., "I am much better at figuring things out logically than most people," "Reasoning things out carefully is not one of my strong points", reverse scored) and engagement in and enjoyment of thinking in an analytical manner (e.g., "I prefer complex to simple problems," "I enjoy problems that require hard thinking"). Responses were made on a 5-point scale ranging from *definitely false* (1), *mostly false* (2), *undecided or equally true and false* (3), *mostly true* (4), to *definitely true* (5). The rationality index was created by summing 12 item scores, which ranged from 26 to 58 (α = .81, *M* = 42.74, *SD* = 6.15). The cutoff for the rationality median split was 42. The mean low rationality score was 37.85, and the mean high rationality score was 47.82.

Hypothesis tests. To assess the role of anthropomorphic characters (*H1a*) and rationality (*H1b*) in moderating flattery effects on overall evaluations of the computer, a 2 × 2 × 2 (Computer comments × Output format × Dichotomized rationality) ANOVA was performed on perceived social attractiveness and perceived believability, respectively.[1] For social attractiveness, two significant main effects emerged. First, participants attributed greater social attractiveness to the flattering computer ($M = 23.17$, $SD = 8.84$) than the one generating factual feedback ($M = 17.89$, $SD = 7.90$), $F(1, 196) = 15.14$, $p < .001$, $\eta^2_p = .07$. Second, anthropomorphic characters ($M = 21.96$, $SD = 9.26$) made the computer more socially attractive than did the simple text output ($M = 18.57$, $SD = 7.57$), $F(1, 196) = 6.20$, $p = .01$, $\eta_p^2 = .03$. No other main or interaction effects were statistically significant, all Fs < 2.20, all ps $> .14$.

For perceived believability, only the main effect for output format was significant, $F(1, 196) = 4.16$, $p = .04$, $\eta_p^2 = .02$. Specifically, humanlike characters ($M = 12.84$, $SD = 6.12$) rendered the computer more believable than did simple text output ($M = 11.30$, $SD = 5.66$). Although the difference did not reach statistical significance, low rationals ($M = 12.77$, $SD = 6.01$) tended to rate the computer as more believable than did their more analytical counterparts ($M = 11.73$, $SD = 5.94$), $F(1, 196) = 3.28$, $p = .07$, $\eta_p^2 = .02$. No other effects were statistically significant, all Fs < 1.69, all ps $> .19$. Taken together, neither *H1a* nor *H1b* was supported.

H2a-2b concerned how humanlike cartoon characters (*H2a*) and the participant's rationality (*H2b*) moderate flattery effects on participants' self-evaluations, if any. A 2 × 2 × 2 ANOVA on participants' self-confidence yielded a significant interaction between dichotomized rationality and output format, $F(1, 196) = 4.09$, $p = .04$, $\eta_p^2 = .02$. Simple effects tests showed that low rationals' self-confidence was significantly lower when humanlike characters represented the computer ($M = 25.97$, $SD = 21.53$) than when simple text was used ($M = 35.50$, $SD = 23.53$), $F(1, 200) = 5.35$, $p = .02$, $\eta_p^2 = .03$. By contrast, high rationals' self-confidence did not vary whether there was a cartoon character ($M = 33.16$, $SD = 18.75$) or not ($M = 30.91$, $SD = 19.29$), $F < 1$. When the interaction was decomposed for each output format, high rationals tended to exhibit greater self-confidence than lows only when humanlike characters conveyed the computer responses, $F(1, 200) = 3.80$, $p = .05$, $\eta_p^2 = .02$. When no character was used, high and low rationals did not differ in their self-confidence, $F < 1$. No other effects were statistically significant, all Fs < 1.73, all ps $> .19$.

To address the questions of how flattery affects conformity decisions, in conjunction with output format (*RQ1a*) or the user's rationality (*RQ1b*), a 2 × 2 × 2 ANOVA was performed on the number of questions for which participants accepted the computer's suggestions. A significant interaction emerged between computer comments and dichotomized rationality, $F(1, 196) = 4.49$, $p = .04$, $\eta_p^2 = .02$. Decomposition of the interaction showed that low rationals became less likely to conform to the computer when flattered ($M = 2.40$, $SD = 1.55$) than when given strictly factual feedback ($M = 3.28$, $SD = 1.38$), $F(1, 200) = 9.70$, $p = .002$, $\eta_p^2 = .05$. By contrast, high rationals' conformity remained virtually identical whether the computer flattered ($M = 2.35$, $SD = 1.34$) or not ($M = 2.29$, $SD = 1.40$), $F < 1$. When high and low rationals' conformity scores were compared within each comment type, it was when generic comments were used that low rationals were more prone to accept the computer's suggestions than their more analytical counterparts, $F(1, 200) = 11.64$, $p = .001$, $\eta_p^2 = .05$. With flattering feedback, rationality had no significant effects on conformity, $F < 1$. Significant main effects for both rationality and computer comments should be interpreted in the context of this interaction, $F(1, 196) = 6.05$, $p = .02$, $\eta_p^2 = .03$; $F(1, 196) = 4.99$, $p = .03$, $\eta_p^2 = .03$, respectively. No other effects were statistically significant, all Fs < 1.

Given that the trivia questions had objectively correct answers, participants' prior knowledge might have affected conformity decisions. After all, if participants had known the correct answer, they would not have changed their answer, no matter what. However, a series of chi-square analyses showed that those who initially picked the correct answer were no less likely to switch to the computer's answer, all χ^2s < 2.47, all ps > .11. It appears that some participants picked the correct answer, not necessarily knowing that it was the right one. In addition, there were no significant main or interaction effects on perceived validity of the computer feedback, except that those in the character conditions tended to ascribe greater validity to the computer's claims than their text-only counterparts, $F(1, 196) = 3.19$, $p = .08$, $\eta_p^2 = .02$.

Discussion

To evaluate two competing, albeit not incompatible, explanations for CASA, Experiment 1 investigated how humanlikeness of the interface and users' analytical thinking style moderate the effects of blatantly insincere praise from the computer on users' affective and behavioral reactions. Based on the anthropomorphism account, it was predicted that more humanlike computers would facilitate social responses to computers and amplify flattery effects, but no such effects emerged. Instead, there was a significant main effect for output format, such that participants in the character condition rated the computer higher on social attractiveness and believability, as compared to those in the text-only condition. These results are consistent with Yee, Bailenson, and Rickertsen's (2007) meta-analysis on the effects of anthropomorphic agent. After reviewing studies that compared interfaces with visually embodied agents and those without agents, they concluded that facial representation yield more positive social interactions, especially in terms of subjective evaluations. Still, the presence of human-looking cartoon characters did not amplify flattery effects, lending little support to the anthropomorphism explanation for CASA.

However, individuals' rationality had some moderating effects. First, only low rationals' self-confidence was significantly affected by the presence of humanlike characters, whereas high rationals' self-perception remained intact regardless of how the computer presented its output. On one level, these findings suggest low rationals' greater susceptibility to peripheral cues; that is, low rationals were more influenced by the look and feel of the interface than were their more analytical counterparts. On another level, it is noteworthy that cartoon characters, which induced more positive overall evaluations of the computer, had the opposite effect on low rationals' self-confidence. One possible explanation pertains to social facilitation effects, which refer to the finding that the presence of others fosters the emission of dominant responses, resulting in better performance for easy tasks and poorer performance for challenging ones (Zajonc, 1965). Perhaps, low rationals, who attribute relatively lower baseline analytical skills and abilities to themselves, might have experienced greater performance anxiety in front of the anthropomorphic computer agent, as compared to when no clear human referent was ostensibly monitoring their performance. Just as the use of human face (vs. simple text) heightened social presence and induced a stronger social desirability bias (Sproull et al., 1996), the presence of a human-looking character might have reminded participants of a human partner. Consistent with this explanation, a recent study (Park & Catrambone, 2007) reported the social facilitation effects of a virtual human on the computer screen. Specifically, the presence of the computer agent (vs. working alone) enhanced the participants' performance when the task was easy, but it worsened the performance when the task was difficult. If social facilitation indeed accounts for the changes in individuals' self-perception in the presence of human-like characters, it merits note that only low rationals showed this particular form of social response toward a computer.

Another moderating effect of rationality pertains to low rationals' negative reactions to the flattering computer's influence attempts. Specifically, low rationals were less, not more, likely to accept the computer's suggestions when flattered than when presented with factual feedback. By contrast, high rationals' conformity decisions did not vary as a function of insincere praise from the computer. Again, this result might simply imply that less analytical thinkers tend to make decisions on the basis of inconsequential information. Knowing that the computer's comments carry no informational value, there should have been no differences in participants' reactions whether the computer flattered or not. At the same time, the fact that flattery lowered, rather than enhanced, conformity seems to invite two alternative interpretations. Possibly, it might reflect the sinister attribution error documented in interpersonal influence settings, which is characterized by irrational distrust and inferences of sinister intentions (Kramer, 1994). In Main, Dahl, and Darke's (2007) study, for example, consumers perceived the salesperson as less trustworthy even when flattery occurred after the purchase and thus did not warrant the suspicion of ulterior motive (Experiment 1). Moreover, such effects were not mediated by an effortful attribution process but by rather automatic negative association (Experiment 2). Just as flattery from a sales agent serves "as a categorization cue that causes consumers to automatically infer sinister intentions" (Main et al., 2007, p. 59), less analytical thinkers might have categorically dismissed the flattering computer's influence attempts.

However, use of such heuristics in the current context might not be interpreted unequivocally as a sign of mindlessness. Although the computer is unlikely to have any ulterior motives, an arguably rational basis for discounting a flatterer's remarks, becoming more guarded and skeptical when it apparently tries to influence your decision with lavish praise might indicate mindful cognitive functioning. Put differently, considering that "people can scrutinize cues peripheral to the message content, or they can process the message content heuristically" (Todorov, Chaiken, & Henderson, 2002, p. 195), the dismissal of the computer's suggestions on account of placebic praise might well exemplify systematic processing. Likewise, the lack of differentiation between flattery and generic comments might not necessarily mean that high rationals elaborated on the comments and then deliberately suppressed the flattery heuristics as irrelevant. Instead, they might have been too focused on answering trivia and thus had less processing resources available for additional considerations. Experiment 2 was conducted to address this interpretational ambiguity.

Experiment 2

In Experiment 1, individuals' rationality score was used as a proxy measure of chronic mindfulness, which revealed some problems. First, there was asymmetry between how anthropomorphism and mindlessness explanations were evaluated. That is, whereas the former was tested through experimental manipulation of a situational variable, the latter hinged on individuals' predispositions. Second, it was unclear what people were mindful about. High rationals who, by definition, enjoy difficult problem-solving tasks might have been too preoccupied with the trivia game and thus ignored other peripheral cues, such as humanlike cartoon characters and flattering comments. In such a case, the null effects of anthropomorphic characters and flattery among high rationals do not necessarily support the mindlessness account. To address these limitations, Experiment 2 varied the cognitive load imposed upon study participants and examined how reduced cognitive capacity moderates the effects of flattery from a computer.

Although mindlessness theory does not assume "the existence of capacity limitations" nor does it attribute mindless information processing to such limitations (Langer, 1992), it seems unreasonable to believe that people can engage in "a fully conscious, active mode of processing information" (p. 301), regardless of the situational constraints that potentially usurp their cognitive resources, at least temporarily. Consistent with this view, the amount of time to think about a discussion topic had differential effects on performance depending on the familiarity of the topic, as the time constraint hampered mindful consideration of topic-related thoughts and led people to rely upon existing scripts (Langer & Weinman, 1981). Similarly, Dolinksi et al. (2002) have shown that sudden emotional changes disrupt individuals' cognitive functions, and such temporary disruption induces mindless compliance to small requests.

Particularly germane to the present study is Gilbert, Pelham, and Krull's (1988) study on cognitive busyness and person perception. In their study, when participants were simultaneously engaged in two tasks, they failed to take into account situational constraints in inferring a target person's personality. That is, even though they gathered under what particular condition the target person was operating (e.g., discussing relaxing versus anxiety-provoking topics), they were less likely to attribute the target's behavior to the situation when multitasking. Although the findings were not discussed in light of mindlessness, considering that mindlessness entails the failure to consider qualifying conditions for a given phenomenon and reduced awareness of alternative conceptions (Langer, 1989, 1992), dispositional attribution in the face of a strong situational constraint appears to represent a mindless behavior. Following this logic, and based on the mindlessness account for CASA, Lee (2008) predicted and found that participants were more likely to gender stereotype computers when they were dealing with multiple than a single task. Just as people failed to adjust their personality inferences in consideration of situational demand while working on two tasks (Gilbert et al., 1988), participants erroneously ascribed gender-stereotypic qualities to a genderless machine when they were cognitively busy.

If mindlessness indeed explains why people respond differently to flattering than non-flattering computers, flattery effects should be more pronounced in the two-task than the one-task condition, where individuals' processing resources are temporarily deprived. Moreover, if flattery lowered conformity due to the mindless attribution of sinister intention to the machine (Experiment 1), the same effect would emerge under the two-task (vs. one-task) condition. Otherwise, the notion that mindlessness explains low rationals' negative reactions toward the flattering computer will be challenged.

> *Hypotheses 3a-3b (H3a-3b):* Participants will attribute greater (a) social attractiveness and (b) believability to the computer that presents flattering than generic feedback. Such a tendency, however, will be more pronounced when they are engaged in two tasks, as compared to one.
>
> *Hypothesis 4 (H4):* Participants will evaluate their own performance more positively when the computer provides flattering than generic feedback. Such a tendency, however, will be more pronounced when they are engaged in two tasks, as compared to one.
>
> *Research Question 2 (RQ2):* How will the number of cognitive tasks moderate the effects of flattery on the acceptance of the computer's suggestions?

Method

Participants. Participants were 149 college undergraduates (74 men, 75 women) enrolled in communication classes. They were randomly assigned in a 2 (Comments type: Flattery vs. Generic comments) × 2 (Number of task: One vs. Two) between-subjects design experiment.

Procedure. The experimental procedure was identical to that of Experiment 1, except that (a) no cartoon characters were used, and (b) those in the two-task condition were given a nine-digit number to memorize at the end of the practice round and were instructed to rehearse the number during the interaction. To give an incentive to follow the instruction, participants were told that only those who correctly remembered the number would enter a drawing to win a gift certificate. Those in the one-task group skipped this part.

Results

Manipulation check. To establish that the number-rehearsal task significantly increased cognitive load, participants were asked four questions based on the information included in the computer's feedback. For example, to the question about the inventor of the potato chip, the computer provided the following feedback: "Wrong. A is the right answer. William Painter invented the Saratoga Chip, now known as the potato chip." One recall question asked, "What was the original name of the potato chip?" An independent-samples t test on the number of correct answers confirmed that those in the one-task condition recalled the information better ($M = 2.23$, $SD = 1.03$) than their two-task condition counterparts ($M = 1.85$, $SD = 1.06$), $t(147) = 2.21$, $p = .03$.

Index construction. All indices were constructed as in Experiment 1. A factor analysis yielded a two-factor solution that accounted for 76.26% of the original variance. For social attractiveness, participants indicated how likable, sociable, friendly, and personal the computer was on a 10-point scale (1 = *describes very poorly*, 10 = *describes very well*). The scores were summed across the three items (Eigenvalue = 4.16, $\alpha = .86$, $M = 18.45$, $SD = 8.16$). Likewise, perceived believability was indexed by summing the participants' ratings of the computer on trustworthy, reliable, and honest (Eigenvalue = 1.18, $\alpha = .89$, $M = 10.94$, $SD = 5.46$).

Participant's self-evaluation was measured by asking how confident they were about their initial answer on an 11-point scale before seeing the computer's feedback, which ranged from 0% to 100% in 10% increments. The ratings were averaged across five critical trials ($\alpha = .84$, $M = 33.92$, $SD = 21.83$).

Conformity was measured by counting how many times, out of the five questions for which the computer suggested a different answer, participants switched to the computer's answer. Conformity score ranged from 0 to 5 ($M = 2.36$, $SD = 1.48$). After choosing the final answer for each question, participants also estimated how likely the computer had presented the correct answer on an 11-point scale, ranging from 0% to 100% in 10% increments. The ratings were then averaged to yield the index for perceived validity of the computer feedback ($\alpha = .76$, $M = 39.52$, $SD = 17.86$).

Hypothesis tests. *H3a-3b* concerned how flattery from the computer alters users' perceptions of the computer, in terms of social attractiveness and believability. First, a 2 × 2 (Computer comments × Number of task) ANOVA on social attractiveness found that participants perceived the flattering computer ($M = 20.32$, $SD = 8.27$) to be more socially attractive than the one generating factual feedback ($M = 16.60$, $SD = 7.65$), $F(1, 145) = 7.85$, $p = .006$, $\eta_p^2 = .05$.[2] No other main or interaction effects were statistically significant, Fs < 1. Thus, *H1a* was only partially supported, replicating the original flattery study. A 2 × 2 ANOVA on perceived believability, however, revealed no significant main or interaction effects, failing to support *H1b*, all Fs < 1.24, all ps > .26.

H4 addressed the question of how flattering comments from the computer might affect users' self-evaluation. A 2 × 2 ANOVA on participants' initial self-confidence yielded no significant main or interaction effects, all Fs < 1.49, all ps > .22.

RQ2 pertained to the flattery effects on conformity behavior. When a 2 × 2 ANOVA was performed on conformity, a significant interaction emerged between the number of task and computer comments, $F(1, 145) = 4.39$, $p = .04$, $\eta_p^2 = .03$. Simple effects tests showed that when participants were assigned only one task, they were more likely to conform to the generic-comment computer ($M = 2.86$, $SD = 1.51$) than the flattering one ($M = 2.06$, $SD = 1.53$), $F(1, 145) = 5.37$, $p = .02$, $\eta_p^2 = .03$, whereas those handling multiple tasks did not respond differently whether the computer presented generic ($M = 2.15$, $SD = 1.40$) or flattering comments ($M = 2.36$, $SD = 1.42$), $F < 1$. When the interaction was decomposed for each comment type, it was when generic comments were used that one-task participants showed greater conformity than their two-task counterparts, $F(1, 145) = 4.21$, $p = .04$, $\eta_p^2 = .03$. With flattering comments, the number of task did not exert a significant effect on participants' conformity decision, $F < 1$.

To assess the possibility that flattery lowered conformity by elevating suspicion about the validity of the computer's output, a la sinister attribution error (Main et al., 2007), a 2

× 2 ANOVA (Computer comments × Number of task) was computed on the perceived likelihood of the computer presenting the correct answer. Unlike Experiment 1, there was a significant interaction, which replicated the pattern of the conformity results, $F(1, 145) = 5.12$, $p = .03$, $\eta_p^2 = .03$. When focusing on a single task, those flattered by the computer thought that the computer was less likely to present the correct answer ($M = 35.88$, $SD = 18.61$) than those who received generic comments ($M = 44.11$, $SD = 17.77$), $F(1, 145) = 3.84$, $p = .05$, $\eta_p^2 = .03$. By contrast, computer comments evoked no such differences among those assigned the secondary task, $F = 1.51$, $p = .22$. Moreover, perceived validity of the computer's comments was positively correlated with the acceptance of the computer's answer ($.24 < r$s $< .36$, ps $< .004$).

Lastly, a 2 × 2 (Comments type × Number of task) ANOVA was computed on the number of correct answers for the five critical questions. No significant main or interaction effects were found, suggesting that there were no systematic differences in prior knowledge across conditions, all Fs < 1. In addition, a series of chi-square analyses confirmed that except for one question ($\chi^2 = 4.08$, $p = .04$), those who picked the correct answer were not any less likely to switch to the computer's answer, all χ^2s < .77, all ps > .38.

Discussion

To evaluate the mindlessness explanation more closely, Experiment 2 varied the number of tasks participants engaged in and examined whether increased cognitive load would amplify the flattery effects. Consistent with Experiment 1, flattery garnered higher ratings of social attractiveness, but it enhanced neither perceived believability of the computer nor participants' self-evaluation. Moreover, flattery had the same negative effects on conformity as manifested by low rationals in Experiment 1 but only among those assigned a single task. Contrary to the prediction informed by the mindlessness explanation, people were more likely to evince flattery effect when they were less cognitively busy.

At the very least, the fact that flattery effects were more pronounced in the one-task condition casts doubt on the mindlessness account for social responses to computers. That is, when people's ability to mindfully process and respond to social stimuli is temporarily impaired due to increased cognitive demand, they actually showed no differentiation between flattering and nonflattering computers. Rather, it was those with more cognitive resources available who became more skeptical about the truth value of the flattering computer's claims and made a conformity decision accordingly. Taken together, it appears that the secondary task disrupted individuals' ability to evaluate external stimuli and adjust one's own behavior in light of the situational idiosyncrasy; that is, participants became more suspicious of the computer's feedback and less likely to accept its suggestions after receiving obviously insincere praise from the computer, but such adjustments did not occur when they were simultaneously handling more than one task.

However, the current results directly contradict the previous finding that gender stereotyping of computers was more pronounced when cognitive load was increased by means of a secondary task (Lee, 2008; Experiment 1). Put it differently, cognitive busyness facilitated one particular type of social responses (gender stereotyping) to computers, whereas it inhibited another kind (flattery effects). What might potentially help to resolve such inconsistency is Gilbert and Hixon's (1991) demonstration of how cognitive busyness affects the activation and application of racial stereotypes differently. Contrary to the common belief that stereotypes are activated automatically, they predicted and found that stereotype activation requires processing resources. Specifically, the exposure to an Asian target activated associated stereotypes only among those who were assigned a single task and not among those dealing with multiple tasks (Experiment 1). However, once stereotypes were activated, cognitively busy participants were more likely to apply stereotypes to an individual target (Experiment 2), perhaps because they lacked cognitive resources required to modify their responses not to appear prejudiced (behavioral suppression account) or to form individuated impressions of the target (individuation account).

If gender stereotypes, unlike ethnic stereotypes, are chronically salient, and thus do not require much processing efforts for activation, cognitive busyness should have facilitated the application of already activated stereotypes, even to computers. By contrast, second guessing a flatterer's intention and discounting the value of his or her comments is more cognitively taxing than simply accepting whatever is said at face value. Consequently, such deliberative reactions might well have been hindered when the secondary task claimed its share of processing resources. In this view, Johnson et al.'s (2004) finding that more experienced computer users showed greater flattery effects than their less experienced counterparts might not necessarily support the mindlessness explanation. Of course, as the authors argue, it might be that greater computing experience led people to "mindlessly apply human schemas and expectations to computers" (Johnson et al., 2004, p. 242), just as practice leads to overlearning and fosters mindless reactions (Langer & Imber, 1979). At the same time, however, the results might indicate that novice users, too caught up with barely managing the experimental task, had less cognitive resources than needed to invoke the flattery script, like those in the dual-task condition in the current study. Although more systematic investigation should evaluate this conjecture, opposite effects of cognitive busyness on gender stereotyping and flattery effects suggest that not all social responses to computers are created equal; that is, mindlessness might account for some social responses to computers better, whose activation is more or less automatic and demands little cognitive processing.

Alternatively, one might attribute the null flattery effect on conformity among two-task participants to a manipulation failure. That is, they might have been distracted too much by the number rehearsal task that they were not even capable of encoding the semantic differences between flattery and generic comments. In other words, among the three subprocesses of information processing proposed by the limited capacity model of mediated message processing (Lang, 2000), cognitive busyness might have mostly interfered with the encoding of the stimuli, rather than the retrieval of the relevant social script, as suggested above. Albeit plausible, the finding that flattery increased perceived social attractiveness for both busy and nonbusy participants seems to suggest otherwise. Had cognitive busyness impaired encoding of the textual variation, those in the two-task condition should have shown no flattery effects on social attractiveness, either.

Then why did cognitive busyness fail to suppress the flattery effects on social attractiveness? Possibly, it might have to do with the timing of measurement. Unlike other dependent variables (e.g., conformity, self-evaluation), social attractiveness was measured after the trivia game was over. With processing resources devoted to answering trivia freed up, those in the two-task condition were perhaps no longer cognitively busy or at least less busy than when they were judging the validity of the computer's claims and making conformity decisions while playing the game all at the same time. Thus, they were able to evaluate the computers differently in light of the verbal comments they had received.

Nevertheless, to clarify how cognitive busyness moderates the likelihood of social responses to computers, future research would need to incorporate more direct indices of these subprocesses and investigate which part of information processing is mostly hindered by the secondary task. In Experiment 2, although one-task participants showed better recall memory than their two-task counterparts, it does not offer conclusive evidence that, overall, they were more mindful. Instead, it might simply reflect differential allocation of limited cognitive resources across the aforementioned subprocesses; that is, the two-task group could have been as mindful as the one-task group, and yet they allocated more resources to encoding, thereby leaving insufficient resources for storage and retrieval.[3] Since recall is better suited to measure retrieval, rather than message encoding (Lang, 2000), such differences might have been undetected. Therefore, to better understand the role of mindlessness in eliciting social responses to computers, it seems pivotal to use supplementary measures tapping underlying cognitive processes, such as recognition and secondary task reaction time.

General Discussion

The present experiments examined whether social responses to computers are more likely to occur when (a) the interface more closely resembles or somehow reminds of a human interactant, (b) users are chronically less prone to analytical thinking, and (c) users are temporarily deprived of processing resources. Departing from previous HCI research (e.g., Cassell & Thorisson, 1999; Parise et al., 1999), which focused on whether anthropomorphic interface makes the interaction more pleasant and the system more trustworthy (anthropomorphism as an independent variable), the current research investigated whether anthropomorphic interface facilitates the tendency to apply social heuristics to computers (anthropomorphism as a moderator). In addition, individual differences in cognitive style as well as situational factors were also considered to understand what underlies flattery effects in HCI as well as to define potential boundary conditions for CASA.

Theoretical Implications for CASA

Overall, the current findings provided little support for the anthropomorphism explanation. Anthropomorphic characters, coupled with text output, significantly improved participants' overall perceptions of the computer, but they did not accentuate flattery effects (Experiment 1). Instead, an interesting interaction between anthropomorphic features of the interface and user dispositions emerged, such that the anthropomorphic interface lowered participants' self-confidence only among those who are less predisposed to effortful information processing. What merits note, however, is that the present research constitutes an extremely conservative test of the anthropomorphism explanation. Original conceptualization of anthropomorphism entails more fundamental characteristics of humans, such as interactivity, use of language, and endowment of social roles (Nass & Moon, 2000; Sundar & Nass, 2000), all of which were manifest in both more and less anthropomorphic interfaces implemented in Experiment 1. Although a manipulation check confirmed that participants' ratings of humanlikeness were significantly higher for the text-plus-cartoon characters than text-only conditions, even the text-only computer might have been considered as sufficiently humanlike to warrant social responses, given its ability to interact with participants using natural language. Therefore, for a fairer test of the anthropomorphism account, future research should consider different operationalizations of anthropomorphism. For example, measuring individuals' overall tendency to anthropomorphize computers (Sundar, 2004) and investigating how it moderates the likelihood of social responses to computers appears to be a fruitful venue.

Mindlessness account was evaluated based on dispositional (rationality) and situational (cognitive load) variables. Consistent with the mindlessness explanation, less analytical thinkers were more likely to exhibit flattery effects (Experiment 1). Still, the results are somewhat equivocal in that mindlessness was indirectly inferred from individuals' cognitive style, and thus it remains unclear toward what they were more or less mindful. When mindlessness was experimentally manipulated by varying cognitive load (Experiment 2), those under greater cognitive duress were less likely to display flattery effects, challenging the mindlessness explanation. On the one hand, the isomorphism between low rationals' responses and those emitted by less cognitively busy participants points to the possibility that dismissing the flattering computer's feedback might represent rather mindful consideration of peripheral cues as a basis for the conformity decision, as opposed to mindless attribution of malevolent intention to a lifeless machine. On the other hand, it is quite possible that the same results were obtained through totally different processes. For example, high rationals showed no flattery effects on conformity because they were initially suspicious about the flattering computer's claims but then adjusted their responses in consideration of the intentionless machine partner (activation then suppression). Cognitively busy participants, however, might have failed to invoke the flattery schema in the first place (nonactivation) and hence could not integrate it into their conformity decision. Despite such ambiguity, the current findings suggest that social responses to computers are not necessarily the product of mindlessness. Certain social rules require more processing resources for activation than others and might be more likely to materialize in HCI when people are more mindfully operating.

Unlike the original study, flattery did not enhance self-evaluation in both experiments. Several possibilities were entertained to account for the null findings. First, the nature of the current experimental task might have suppressed the flattery effects. In Fogg and Nass' (1997) study, participants created questions, supposedly to be stored in the database and used by the computer later, whose quality could be only subjectively determined. By contrast, the trivia questions employed in the current research have verifiable answers. Thus, participants could tell whether they knew the answer, although it was still possible that they picked the right answer by chance. This might have equipped them with a better sense of their performance, independent of the arbitrary feedback they received from the computer, hence limiting the impact of computer comments. Second, even in the flattery condition, participants were told that they picked an incorrect answer for 5 out of 12 questions, which could have mitigated the ego-boosting effects of flattering feedback. Third, the way self-evaluation was operationalized might also have diluted flattery effects. Unlike the original study that measured self-evaluation in terms of overall evaluations of their experience, such as how well participants felt they performed, how satisfied they were with their performance, and how favorably subjects would rate their performance compared to other subjects, the current research asked participants to indicate how confident they are about their initial answer for each question. When forced to specifically assess the likelihood of being correct, participants might have become more mindful and thus less influenced by such peripheral cues as flattery. Consistent with this speculation, a recent study (Lee, 2008) showed that whereas computer gender elicited stereotype-consistent overall perceptions of the computer, it had no corresponding effect on how likely participants thought the computer had presented the correct answer for each question.

Limitations

Some aspects of the current research might limit the generalizability of the findings. First, participants were explicitly told that the computer might present an incorrect answer, for otherwise they would have invariably accepted the computer's answer. Combined with the low self-confidence ratings (30%), such manipulation might have led people to process the computer messages more carefully than in other situations where the computer's correctness is reasonably assumed. However, it is not uncommon that users encounter various kinds of hardly verifiable information on the Internet, such as product-related claims and health information. In fact, in response to growing concerns about inaccurate and misleading information on numerous Web sites, researchers have examined how people judge the credibility of Web-based information (e.g., Dutta-Burgman, 2004; Flanagin & Metzger, 2007) and noted that "ascertaining web site credibility is increasingly more difficult" (Warnick, 2004, p. 263). Still, to ensure ecological validity of the present findings, future research should examine if they are replicable in a situation in which people are not particularly encouraged to suspect the validity of information offered by the computer.

Second, this study systematically varied the message contents (flattery vs. generic comments) and investigated how some individual differences and contextual changes moderate individuals' responses to this semantic variation. However, not all social attributions are as strongly bound to the message content as flattery effects, and their activation and/or application might not depend as heavily on cognitive resources people are willing and able to expend at the moment. For example, when people displayed more positive reactions to the computer that belonged to the same (vs. different) group as they did (Nass, Fogg, & Moon, 1996), the effects stemmed primarily from the identity of the computer (in-group vs.

out-group), not the messages it generated. Moreover, the same social rules might become more or less easily invoked, depending on how cues to those rules are presented. Gender stereotypes, for instance, are rather automatically triggered when gender cues are visually or orally communicated but perhaps less so verbally; that is, if computer gender is revealed through gender-typed language forms, gender stereotyping of computers might become less likely under increased cognitive load, just the opposite of Lee's (2008) findings. Therefore, to better understand the theoretical implications of the present results, future research should examine both mindlessness and anthropomorphism explanations using a wide range of social heuristics in various task environments.

Lastly, the current findings demand our attention to the question of how mindlessness can be unambiguously manipulated or measured. In Experiment 1, unlike previous studies focusing on mindlessness as a temporary state varying from situation to situation, rationality was measured as an index of chronic mindfulness. Similarly, instead of varying individuals' motivation to process information mindfully (e.g., Langer et al., 1978), Experiment 2 disrupted individuals' ability for mindful cognitive functioning by increasing cognitive load. Although studies have shown that high rationals (e.g., Berger, Lee, & Johnson, 2003) and those assigned an additional task (e.g., Gilbert et al., 1988) exhibited the definitional characteristics of mindlessness, they did not directly measure the psychological state of mindlessness. If one is to evaluate the mindlessness explanation for CASA findings, more effort should be expended to develop a measure of mindlessness with acceptable degrees of validity and reliability.

Conclusion

In attempts to address when and why people make social attributions to computers, the present research examined how humanlikeness of the interface as well as chronic and temporary mindlessness alters their responses to computers that flatter. Results showed that adding anthropomorphic characters does not necessarily precipitate users' proclivity to apply social heuristics to the computer, failing to support the anthropomorphism explanation for CASA. As for the mindlessness account, mixed findings emerged. Specifically, when mindlessness was operationalized in terms of individuals' rational thinking style, those less prone to analytical thinking were not only more sensitive to anthropomorphic cues embedded in the interface but they were also more likely to show flattery effects. However, when mindlessness was temporarily induced by increasing cognitive demand of the situation, flattery effects tended to dissipate. Such divergent findings, at the very least, suggest that social responses to computers do not necessarily represent automatic reactions to interactive technology wired in human brain, which await external triggers. Instead, some social responses might occur as a result of rather effortful activation of social scripts potentially relevant to the given situation. By implementing various forms of anthropomorphic interfaces and developing more direct measures of mindlessness, future research should elucidate what underlies seemingly prevalent social treatment of computers.

Thus far, CASA researchers have focused on rather disconnected, individual instances of phenomena that (dis)confirm the equation, "computers are social actors." To move beyond mere descriptions of interesting observations and explain why computers are treated as such, it seems imperative to consider alternative measurement techniques other than self-reports, whose validity is often questioned due to people's inability to verbalize their internal processes as well as the motivational bias to project a positive self-image. For example, it would be interesting to see if the same part of the brain gets activated when interacting with a person versus a computer that emulates more or less humanlike attributes. Similarly, if some individuals are less likely to emit social responses to computer than others, various physiological data, such as fMRI and EEG, might help to determine whether it is because they somehow manage to undo social responses evoked by humanlike stimuli or because they do not have appropriate social scripts activated from the beginning. This is why ever-increasing interest in less traditional measures in our field seems particularly promising with respect to the CASA paradigm.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The author disclosed receipt of the following financial support for the research and/or authorship of this article: This research was financially supported in part by the Institute of Communication Research, Seoul National University.

Notes

1. To see if the gender of the cartoon characters had significant effects on dependent variables, a series of 2 × 2 × 2 × 2 (Computer comments × Character gender × Dichotomized rationality × Participant gender) ANOVAs was computed using character conditions only. Results showed no statistically significant main or interaction effects for character gender, all Fs < 2.56, all ps $> .11$, except that male characters tended to elicit higher ratings of perceived believability than their female counterparts, $F(1, 111) = 3.80$, $p = .05$, $\eta_p^2 = .03$. Therefore, the data were pooled between the male- and female-character conditions. Participant gender was excluded from the analysis because (a) it was not of significant theoretical interest in the current investigation, and (b) it was a nonsignificant covariate for all dependent variables, all Fs < 2.37, all ps $> .12$, except for perceived believability, $F(1, 195) = 6.00$, $p = .02$, $\eta_p^2 = .03$. In all cases, results reported herein remained unaltered after participant gender was covaried out.
2. A series of 2 × 2 × 2 (Computer comments × Number of task × Participant gender) ANOVAs revealed some gender differences. For example, as compared to women, men tended to attribute greater social attractiveness to the computer, $F(1, 141) = 3.41$, $p = .07$, $\eta_p^2 = .02$, rated the computer as more believable, $F(1, 141) = 7.41$, $p = .007$, $\eta_p^2 = .05$, and were more likely to accept the computer's suggestions, $F(1, 141) = 7.44$, $p = .007$, $\eta_p^2 = .05$. However, gender was of little theoretical interest in the present research, and there were no significant interaction effects involving participant gender, all Fs < 2.29, all ps $> .13$. Therefore, participant gender was not included in the analyses reported.
3. The author thanks an anonymous reviewer for suggesting this possibility.

References

Bailenson, J. N., Blascovich, J., Beall, A. C., & Loomis, J. M. (2001). Equilibrium revisited: Mutual gaze and personal space in virtual environments. *Presence*, *10*, 583-598.

Berger, C. R., Johnson, J. T., & Lee, E.-J. (2003). Antidotes for anthrax anecdotes: The role of rationality and base-rate data in assuaging apprehension. *Communication Research*, *30*, 198-223.

Berger, C. R., Lee, E.-J., & Johnson, J. T. (2003). Gender, rationality, and base-rate explanations for increasing trends. *Communication Research*, *30*, 737-765.

Cassell, J., & Thorisson, K. R. (1999). The power of a nod and a glance: Envelope vs. emotional feedback in animated conversational agents. *Applied Artificial Intelligence*, *13*, 519-538.

Chanowitz, B., & Langer, E. (1981). Premature cognitive commitment. *Journal of Personality and Social Psychology*, *41*, 1051-1063.

Chen, S., & Chaiken, S. (1999). The heuristic-systematic model in its broader context. In S. Chaiken & Y. Trope (Eds.), *Dual-process theories in social psychology* (pp. 73-96). New York: Guilford.

Dolinski, D., Ciszek, M., Godlewski, K., & Zawadzki, M. (2002). Fear-then-relief, mindlessness, and cognitive deficits. *European Journal of Social Psychology*, *32*, 435-447.

Dutta-Bergman, M. J. (2004). The impact of completeness and Web use motivation on the credibility of e-health information. *Journal of Communication*, *54*, 253-269.

Eagly, A. H., & Chaiken, S. (1975). An attribution analysis of the effect of communicator characteristics on opinion change: The case of communicator attractiveness. *Journal of personality and social psychology*, *32*, 136-144.

Epstein, S. (1994). An integration of the cognitive and the psychodynamic unconscious. *American Psychologist*, *49*, 709-724.

Epstein, S., & Pacini, R. (1999). Some basic issues regarding dual-process theories from the perspective of cognitive-experiential self-theory. In S. Chaiken & Y. Trope (Eds.), *Dual-process theories in social psychology* (pp. 462-482). New York: Guilford.

Flanagin, A. J., & Metzger, M. J. (2007). The role of site features, user attributes, and information verification behaviors on the perceived credibility of Web-based information. *New Media & Society*, *9*, 319-342.

Fogg, B. J., & Nass, C. (1997). Silicon sycophants: The effects of computers that flatter. *International Journal of Human-Computer Studies*, *46*, 551-561.

Gilbert, D. T., & Hixon, J. G. (1991). The trouble of thinking: Activation and application of stereotypic beliefs. *Journal of Personality and Social Psychology*, *60*, 509-517.

Gilbert, D. T., Pelham, B. W., & Krull, D. S. (1988). On cognitive busyness: When person perceivers meet persons perceived. *Journal of Personality and Social Psychology*, *54*, 733-740.

Hinds, P. J., Roberts, T. L., & Jones, H. (2004). Whose job is it anyway? A study of human-robot interaction in a collaborative task. *Human-Computer Interaction*, *19*, 151-181.

Johnson, D., Gardner, J., & Wiles, J. (2004). Experience as a moderator of the media equation: The impact of flattery and praise. *International Journal of Human-Computer Studies*, *61*, 237-258.

Kramer, R. M. (1994). The sinister attribution error: Paranoid cognition and collective distrust in organizations. *Motivation and Emotion*, *18*, 199-230.

Lang, A. (2000). The limited capacity model of mediated message processing. *Journal of Communication*, *50*, 46-70.

Langer, E. J. (1989). Minding matters: The consequences of mindlessness-mindfulness. In L. Berkowitz (Ed.), *Advances in experimental psychology* (Vol. 22, pp. 137-173). San Diego, CA: Academic Press.

Langer, E. J. (1992). Matters of mind: Mindfulness/mindlessness in perspective. *Consciousness and Cognition*, *1*, 289-305.

Langer, E. J., Blank, A., & Chanowitz, B. (1978). The mindlessness of ostensibly thoughtful action: The role of "placebic" information in interpersonal interaction. *Journal of Personality and Social Psychology*, *36*, 635-642.

Langer, E. J., & Imber, L. (1979). When practice makes imperfect: The debilitating effects of overlearning. *Journal of Personality and Social Psychology*, *37*, 2014-2025.

Langer, E. J., & Weinman, C. (1981). When thinking disrupts intellectual performance: Mindfulness on an overlearned task. *Personality and Social Psychology Bulletin*, *7*, 240-243.

Lee, E.-J. (2008). Gender stereotyping of computers: Resource depletion or reduced attention? *Journal of Communication*, *58*, 301-320.

Lee, K. M., Park, N., & Song, H. (2005). Can a robot be perceived as a developing creature? Effects of a robot's long-term cognitive developments on its social presence and people's social responses toward it. *Human Communication Research*, *31*, 538-563.

Main, K. J., Dahl, D. W., & Darke, P. R. (2007). Deliberative and automatic bases of suspicion: Empirical evidence of the sinister attribution error. *Journal of Consumer Psychology*, *17*, 59-69.

Moon, Y. (2000). Intimate exchanges: Using computers to elicit self-disclosure from consumers. *Journal of Consumer Research*, *26*, 323-339.

Moon, Y., & Nass, C. (1996). How "real" are computer personalities? Psychological responses to personality types in human-computer interaction. *Communication Research*, *23*, 651-674.

Nass, C., & Brave, S. (2005). *Wired for speech: How voice activates and advances the human-computer relationship*. Cambridge, MA: MIT Press.

Nass, C., Fogg, B. J., & Moon, Y. (1996). Can computers be teammates? *International Journal of Human-Computer Studies*, *45*, 669-678.

Nass, C., & Lee, K. M. (2001). Does computer-synthesized speech manifest personality? Experimental tests of recognition, similarity-attraction, and consistency-attraction. *Journal of Experimental Psychology: Applied*, *7*, 171-181.

Nass, C., & Moon, Y. (2000). Machines and mindlessness: Social responses to computers. *Journal of Social Issues*, *56*, 81-103.

Nass, C., Moon, Y., & Green, N. (1997). Are computers gender-neutral? Gender stereotypic responses to computers. *Journal of Applied Social Psychology*, *27*, 864-876.

Pacini, R., & Epstein, S. (1999). The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. *Journal of Personality and Social Psychology*, *76*, 972-987.

Parise, S., Kiesler, S., Sproull, L., & Waters, K. (1999). Cooperating with life-like interface agents. *Computers in Human Behavior*, *15*, 123-142.

Park, S., & Catrambone, R. (2007). Social facilitation effects of virtual humans. *Human Factors*, *49*, 1054-1060.

Petty, R. E., & Cacioppo, J. T. (1986). *Communication and persuasion: Central and peripheral routes to persuasion*. New York: Springer-Verlag.

Pollock, C. L., Smith, S. D., Knowles, E. S., & Bruce, H. J. (1998). Mindfulness limits compliance with the that's-not-all technique. *Personality and Social Psychology Bulletin*, *24*, 1153-1157.

Powers, A., & Kiesler, S. (2006). *The advisor robot: Tracing people's mental model from a robot's physical attributes*. Proceedings of the 1st ACM SIGCHI/SIGART conference on human-robot interaction. Salt Lake City, UT.

Reeves, B., & Nass, C. (1996). *The media equation: How people treat computers, television, and new media like real people and places*. New York: Cambridge University Press.

Sproull, L., Subramani, M., Kiesler, S., & Walker, J. H. (1996). When the interface is a face. *Human-Computer Interaction*, *11*, 97-124.

Sundar, S. S. (2004). Loyalty to computer terminals: Is it anthropomorphism or consistency? *Behaviour & Information Technology*, *23*, 107-118.

Sundar, S. S., & Nass, C. (2000). Source orientation in human-computer interaction: Programmer, networker, or independent social actor? *Communication Research*, *27*, 683-703.

Todorov, A., Chaiken, S., & Henderson, M. D. (2002). The heuristic-systematic model of social information processing. In J. P. Dillard & M. Pfau (Eds.), *The persuasion handbook: Developments in theory and practice* (pp. 195-211). Thousand Oaks, CA: Sage.

Warnick, B. (2004). Online ethos: Source credibility in an "authorless" environment. *American Behavioral Scientist*, *48*, 256-265.

Yee, N., Bailenson, J. N., & Rickertsen, K. (2007). *A meta-analysis of the impact of the inclusion and realism of human-like faces on user experiences in interfaces* (Proceedings of the Conference on Human Factors in Computing Systems [ACM SIGCHI]). New York: ACM Press.

Zajonc, R. B. (1965). Social facilitation. *Science*, *149*, 269-274.

Bio

Eun-Ju Lee (PhD, Stanford University) is an associate professor in the Department of Communication at Seoul National University, Korea. Her research centers on social cognition and social influence, especially in the context of computer-mediated communication (CMC) and human-computer interaction (HCI).

Fonte: Communication Research, Feb. 2010. [Base de Dados]. Disponível em: <http://online.sagepub.com>. Acesso em: 24 fev. 2010.