Effects of Agent Appearance on Customer Buying Motivations on Online Shopping Sites

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Abstract

Although product recommendation virtual agents (PRVAs) are used in a large number of online shopping websites, the optimal types of agents in this context remain unclear. In the present study, we tested whether agent appearance affects people's buying motivations and analyzed the key factors in persuading people to buy products. The experimental results confirmed that recommendation effects vary according to agent appearance. Furthermore, we obtained a partial order ranking of the agent types, representing the effectiveness of their recommendations. The factor analysis results indicated that the perceptions of familiarity and intelligence in relation to appearance are the key factors in persuading people to buy products.

Author Keywords

virtual agent; recommendation; on-line shopping

ACM Classification Keywords

H.5.2 [User Interfaces].

Introduction

Many consumers routinely shop online to purchase various types of products, including electrical appliances, foods, books, clothes, and other commodities. In online shopping environments, product recommendations, which were
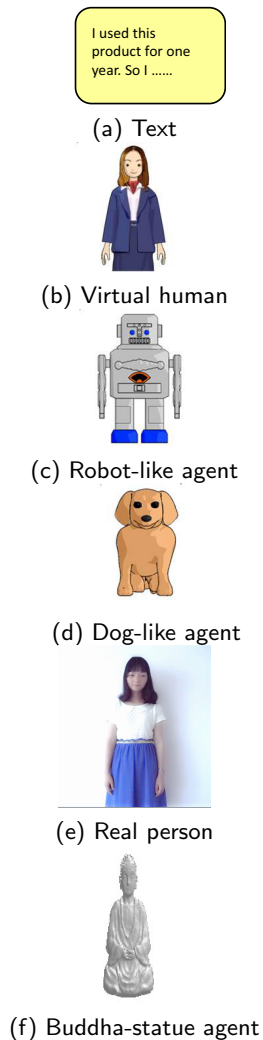
I used this product for one year. So I ......

(a) Text

(b) Virtual human

(c) Robot-like agent

(d) Dog-like agent

(e) Real person

(f) Buddha-statue agent

Figure 1: The six PRVAs used in the experiment

previously provided by salespersons, were once expected to be taken over by product recommendation virtual agents (PRVAs) [10]. However, recent research has suggested that a substantial number of virtual agents on commercial websites have disappeared [8]. Minoun et al. noted that appearance inadequacy and lack of intelligence are the key factors in the disappearance of PRVAs. However, the optimal types of agents for product recommendations remain unclear. Hence, we investigated which types of PRVAs, including those composed of text only or with a video of a real person, are effective through systematic experiments with participants in an online shopping environment.

Although studies on the evaluation of virtual agents in basic tasks [1] and various experimental studies on the properties (e.g., behaviors, appearance, or adaptation) of virtual agents [7, 9] have been conducted, few experimental studies have examined the recommendation effect of PRVAs in online shopping environments. The *recommendation effect* refers to the positive influence of PRVA recommendations on a user's motivation to buy.

Qiu et al. investigated the influence of product recommendation agents on users in different modalities and embodiments in an online shopping environment [10]. This study provided strong evidence for the influence of humanoid embodiments and output modalities in enhancing social interactions. Their main area of interest was the investigation of agent trustworthiness and social presence through systematic experiments using questionnaires.

Various studies have also investigated the properties of virtual agents from a multi-modal perspective [2]. Suitable gestures for virtual agents have also been studied [3]. Unfortunately, few systematic investigations have been

conducted on the properties of PRVAs in online shopping.

We conducted experiments to investigate which types of PRVAs are effective in making recommendations in an online shopping environment. For this purpose, we prepared a simulated online shopping website with representative PRVAs and products. Participants used the website with all combinations of PRVAs and products, evaluated the recommendation effects for each condition and scored their impressions of the products.

Experiment

Design and Materials
We used a six (PRVA) by six (product) within-participants factorial design.

We selected six characteristic PRVAs with regard to the *agency* and *experience* aspects that were investigated by Gray et al., who conducted an experiment with many participants and found that these two significant dimensions characterize various agents [4]. Because we also considered these two dimensions to be significant in classifying PRVAs, we prepared the six PRVAs (250 × 250 pixels) shown in Figure 1, including videos of a real person and text.

We selected six products (Figure 3) for the experiments. We conducted a preliminary experiment to gauge user-buying motivations with 41 participants using a questionnaire that was scored on a seven-point Likert scale and identified the six products whose scores were closest to the intermediate value of four points. The average of the selected products' prices was approximately $12.

We prepared the PRVA recommendations for the products using customer reviews. These recommendations were approximately 200 Japanese words in length and took

(a) Akapakun

(b) Round cushion

(c) Folding board

(d) PC glasses

(e) Mask

(f) Barometer

Figure 3: The six products used in the experiment

approximately 20 seconds for participants to read. A balloon that included the recommendation appeared directly above each PRVA in the experiment.

Figure 2: The main page used in the experiment

We prepared the simulated online shopping website shown in Figure 2. The brief information on each product included a photo ①, the price, the shipping cost, a short explanation of the product as well as a PRVA ② and its recommendation ③ for the product, all of which appeared as in a real online shopping environment. The participants viewed the information and read the PRVA's recommendation. They then rated their buying motivations on a scale that ranged from 0-100 points (0: very weak, 50: neutral, 100: very strong) through a pop-up window that appeared 30 seconds after the web page opened. On the web page, all PRVAs except the one composed of text behaved in the same manner, i.e., slightly moving their heads and making pointing gestures with their right hands, without sound. We set these behavioral restrictions to ensure that PRVAs differed only in terms of appearance.

Participants, procedures and measurements
We recruited 41 participants (28 males and 13 females between the ages of 22 and 26 years). The group consisted of graduate students and staff from the

Computer Engineering department at the Tokyo Institute of Technology who did not have any previous knowledge on PRVAs, especially with regard to their appearance.

Each participant was asked to attempt all 36 combinations of the six PRVAs and six products in an online shopping environment in counter-balanced orders. We set the orders of the combinations carefully so that no PRVA and product appeared two times in a row.

We quantitatively recorded subjective buying motivation. The participants were requested to answer, on a scale ranging from 0 to 100, "How much do you want to purchase this product?"

Additionally, we included 20 questions on a questionnaire to investigate the participants' impressions of the PRVAs, as shown in Table 1. The participants were asked to answer the questions directly after completing their experiments. The responses were recorded on a seven-point Likert scale (1 = "strongly disagree"; 7 = "strongly agree").

Table 1: Experiment questions (adjectives) (SD on a seven-point Likert scale)

Q1	Trustworthy	Q2	Friendly	Q3	Honest
Q4	Assertive	Q5	Bold	Q6	Interesting
Q7	Confident	Q8	Responsible	Q9	Communicative
Q10	Thoughtful	Q11	Intelligent	Q12	Attractive
Q13	Optimistic	Q14	Warm	Q15	Strong
Q16	Sturdy	Q17	Dominant	Q18	Knowledgeable
Q19	Sensible	Q20	Outgoing		

Results

A two-way analysis of variance (ANOVA) on buying motivation confirmed that there were no significant interactions between agents and products ($F_{25,14} = .92$, $p = .57$), whereas the main effects of both agents

($F_{5,14} = 13.6$, $p < .01$) and products ($F_{5,14} = 23.2, p < .01$) were statistically significant. A post-hoc Tukey's test on agents revealed that significant differences were evident between the following eight pairs: human-like agent and real person ($p = .0019$), robot-like agent ($p = .0003$), Buddha statue agent ($p = .0000$), text ($p = .0000$), Buddha statue agent and real person ($p = .0052$), robot-like agent ($p = .0225$), dog-like agent ($p = .0000$), and dog-like agent and text ($p = .0072$). Figure 4 shows the average buying motivation for products and participants plotted against agent type, sorted in ascending order to clarify these eight differences.
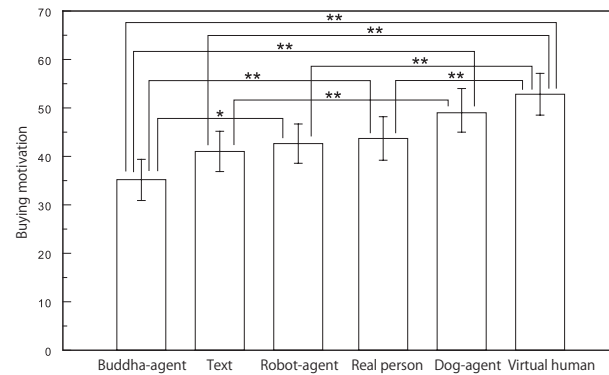

Figure 4: Agent type effect on buying motivation, averaged over products and participants and listed in ascending order. Error bars indicate standard errors. ** $p < .01$, * $p < .05$, + $p < .1$

Furthermore, to investigate the relationship between the PRVA factors and the recommendation effects, we performed a factor analysis (varimax rotation) on the participants' impressions of the PRVAs using the scores on the 20 questions. The results, including the four factors with the top eigenvalues and contribution ratios and the

four questions with the top factor loadings, are shown in Table 2. We interpreted the first four factors as "*Familiarity*," "*Intelligence*," "*Power*," and "*Rightness*" through a careful summarization of the adjectives listed in the answers to the questionnaire (Table 2).

Table 2: Factors [eigenvalue, contribution ratio] and questions (factor loadings)

Factors	Questions with high factor loadings
Familiarity [5.4,27.2%]	Q14(.84),Q12(.79),Q2(.78),Q13(.74)
Intelligence [3.2,15.8%]	Q10(.87),Q11(.81),Q18(.73),Q9(.68)
Power [2.4,12.2%]	Q16(.89),Q15(.83),Q17(.64),Q5(.57)
Rightness [2.3,11.5%]	Q3(.61),Q7(.58),Q4(.46),Q8(.39)

Figure 5 shows the 2D-coordinate of the *Familiarity* and *Intelligence* factors. In this figure, the participants' average impressions of the six PRVAs were plotted and adjusted on the x-y axes.
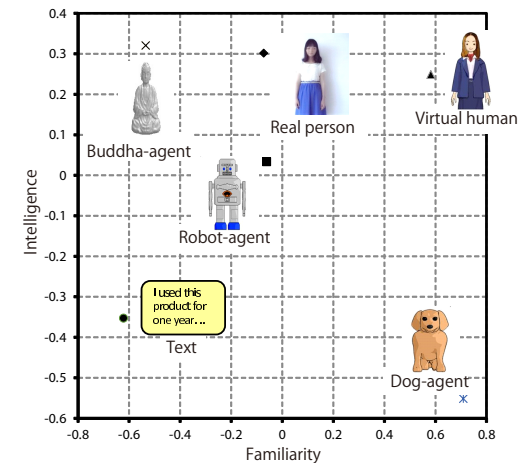

Figure 5: Averaged factor scores for six PRVAs plotted on the *Familiarity-Intelligence* coordination

Table 3 shows the correlation coefficients between the

average buying motivation for the six products and the factor scores for the six PRVAs for all participants. Statistically significant relationships were observed between buying motivation and the scores of three factors, *Familiarity*, *Intelligence*, and *Rightness*.

Table 3: Correlation coefficient between buying motivation and factor scores. ** $p < .01$, * $p < .05$.

	Familiarity	Intelligence	Power	Rightness
Buying motivation	.45 **	.23 *	-.07	.23 *

Discussion

Interactions between agents and products were not statistically observed, indicating that agent and product types independently affect buying motivation. It is quite natural for product type to affect buying motivation because people have their own demands. However, the current results provide clear evidence that agent type affects buying motivation. The recommendation method was controlled across all agents. All agents used the same dialogue window and exhibited the same behaviors. The only difference that the participants observed among the agents was in their appearance. Therefore, the hypothesis that agent appearance affects customer-buying motivations was confirmed.

We obtained a partial order ranking of the types of agents that have a stronger effect on product recommendations. Surprisingly, the recommendation effect of a real person was not particularly high. Rather, the recommendation of a virtual human agent had the strongest effect on participant buying motivations. The reason for this result is clearly shown in Figure 5. The average factor scores for both *Familiarity* and *Intelligence* were high for the virtual human agent, indicating that both factors are necessary to persuade people to buy products in an online shopping environment. However, the factor score of Familiarity was not high for a real person. This might explain why the recommendation effect of a real person was lower than that of a virtual human. The results partially replicated the findings of Mimoun et al., who noted that appearance adequacy and intelligence are key factors for successful PRVAs [8].

It is widely accepted that the human mind has two distinct thought systems, System 1 and System 2 [5]. System 1 is fast, intuitive, and emotional. System 2 is slow, rational, and deliberative. Feelings of positive recognition and familiarity toward others, which are processed in System 1, are known to increase trust [6]. On the other hand, an impression of an agent as having rich, reliable knowledge about products might affect System 2 thought. Therefore, Familiarity and Intelligence might have contributed to the participants' trust in the recommendations of the human agent through System 1 and System 2 thought, respectively.

The lowest factor score was for the dog agent's *Intelligence*. Nevertheless, there were no significant differences in the recommendation effects of the dog and virtual human agents. This is because *Familiarity* is more important than *Intelligence* in persuading people to buy products. This interpretation is evident because the correlation coefficient between buying motivation and the factor score for *Familiarity* was higher than that for Intelligence.

The Buddha statue agent performed the worst in terms of recommending products. Although participants perceived it to have high *Intelligence*, based on associating it with omniscience and omnipotence, they did not emotionally empathize with the statue's recommendations.

The results indicate that the use of text only is not particularly effective in persuading people to buy products. The reliability of information is typically assessed according to the reliability of the person who is the source of the information. Participants might not be able to attribute personality to text recommendations. This is evident from the fact that the factor scores for both *Intelligence* and *Familiarity* were low for text.

Conclusion

In the present study, we aimed to experimentally investigate which types of PRVAs are effective in recommending products for people to buy on an online shopping site. An experiment with six PRVAs with varying appearances confirmed that the recommendation effect varies according to agent appearance. We obtained a partial order ranking of the types of agents that have stronger effects on product recommendations. The results of a factor analysis indicated that *Familiarity* and *Intelligence* are the key factors in determining which types of agents are suitable for making recommendations.

Acknowledgements

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