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## A study on consumers' trust formation model toward recommendation agents: Elaboration Likelihood Model

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### Abstract

It is important to make them have trust in Recommendation Agents (RAs), further enhance their intentions to adopt RAs. This study is based on Elaboration Likelihood Model (ELM) to examine how consumers' (1) (central routes) degree of cognitive effort are affected by providing product-related information, (2) (peripheral routes) degree of social presence are affected by anthropomorphic interface, and (3) product knowledge influence their trust in RAs. We used PLS to analysis the 302 valid samples, and test or verify the hypotheses. The conclusions are as follows: (1) Explanation facility and information search about products significantly increase customers' trust in RAs. (2) Consumers' degree of cognitive effort and telepresence would increase their decision satisfaction and social presence respectively, further their cognitive trust and emotional trust. (3) The experts and novices have different ways to establish their trust in RAs.

*Keywords:* Recommendation Agents, Elaboration Likelihood Model (ELM), Explanation Facility, Information Search, Avatar, Trust, Adoption Intention

### Introduction

E-commerce make small businesses could expand owner business model for low cost. While the connections between large companies and common consumers are much closer than before. Moreover, there is no space constrain on the web. Organizations could provide much more information of product via internet than physical channel. Furthermore, network offers consumers not only a channel to purchase products, but also a way to obtain more options and information about product than before. In addition, it increases species of product for consumers. However, if the choice of product is excessive, it would reduce the attractiveness of the product. Consumers couldn't pick out what they want from numerous products, they even need someone help them make appropriate decisions [2]. Besides, consumers would try to obtain information from variety ways. But people have the problem of information overload while the website provides too many and too complicated information that exceeds the

constraint under which they can handle well. Some online stores apply RAs to assist consumers in searching products and fitting their demands. In particular, online recommendation agents are becoming increasingly available on websites to provide customers with shopping assistance [24], to help buyers and sellers reduce information overload, improve decision quality, and increase product choice confidence [30]. RA technologies are being utilized by a variety of firms, including Yahoo!, Amazon.com, and Sony.com, to provide shopping advice for consumers.

Consumers would feel strange when they use RAs initially, and they wouldn't trust it. For example, User may be concerned about the integrity and benevolence of the RAs. RAs are the objective advice. RAs have ability to solve users' problem. RAs could provide complete information of products. These are important factors to affect consumers' trust in RAs [29]. Therefore, we must persuade consumers changing their attitude toward RAs by various ways, if we want to promote their confidence in it. For example, RA provides information which consumers don't know when they use it. By this way, we can make consumers believe that using RAs to make decision is worthy. Researchers found that information search, explanation facilities and anthropomorphic interface would influence consumers' trust in RAs. We find that consumers would think from a rational point of view since RAs supply information search and explanation facilities. Relatively, they might evaluate RAs from emotional perspective by anthropomorphic interface. According to Elaboration Likelihood Model (ELM), persuasion can take place via two – central and peripheral – based on the moderating effects of ability and motivation for elaboration. The central route occurs when thoughtful consideration of the persuasive message takes place, while the peripheral route refers to a response induced by cues that do not necessitate scrutiny of the central merits of the message [18].

This study is based on ELM. We hope that companies could employ RAs to assist consumers for online shopping, and furthermore help them find most appropriate product with our advices. Research questions include the following: (1) What kinds of antecedents would affect consumers to establish the trust in RAs? (2) How does

presentation of information in different ways influence the consumers' degree of cognitive effort? (3) How does different ways of interpretation influence consumers' degree of social presence? (4) Would consumers' knowledge of products influence them trust in RAs?

## Theoretical Background and Research Hypotheses

### Recommendation Agents

Recommendation Agents (RAs) are software agents that elicit the interests, preferences or past shopping habits of individual users for products, either explicitly or implicitly, and make personalized recommendations accordingly [22][32][33].

RAs are major to help consumers reduce their problem in e-commerce, information overload and cognitive effort, and assist them to find appropriate their needs from vast amounts of product, while at the same time improving their decision quality [33].

RAs are characterized as a type of customer decision support system (DSS). When consumers employ RAs they have to provide inputs (i.e. needs, price and constraints concerning the product desired or ratings on previously consumed products) that the RAs use as criteria for searching products on the Internet and generating advice and recommendations for the customer [32]. In order to convince users to accept that recommendations and trust in it. Accordingly RAs must illustrate that how to analysis their demands and generate results. Therefore, RAs are similar to Knowledge-Based Systems (KBS) [11].

There are three types of RAs include the following [14][28][30]: (2) Content-Based Filtering: generate recommendations based on product attributes the consumer likes, (2) Collaborative Filtering: mimic "word-of-mouth" recommendations and use the opinions of like-minded people to generate recommendations, and (3) Hybrid: integrate content filtering and collaborative filtering methods in generating recommendations.

For the purpose of this study, consumers' trust in and intention to adopt RAs whether these are affected by explanation facility, information search and anthropomorphic interface. We design the RAs of content-based filtering in our research context, and we do not provide other consumers' evaluation or opinions

### Elaboration Likelihood Model (ELM)

Elaboration Likelihood Model (ELM) suggests that a person processes the persuasive messages and changes attitude by elaboration approaches. For the consumers, the process of

using RAs is similar to communicate with a salesperson [17][18]. Salespersons must interpret why when they recommend products to consumers. And the process of recommending is just like a persuasion process to alter consumers' attitude, beliefs or behavior.

Persons gather information through two kinds of routes, such as the central and peripheral route [18]. Before being persuaded by the online recommendation mechanisms, customers gather information through two kinds of routes [13]. When message recipients have both the motivation and the ability to consider detailed information in a given message, persuasion occurs via the central route. In particular, information gathered by the central route is known to persuade customers more effectively, and it has a positive impact on the recipients' attitude. Recipients elaborate the messages rationally through central cues (e.g., function or attributes of product). Relatively, when message recipients lack either the motivation or the ability to process the detailed information in the message content, and they will take peripheral route. Recipients rely on some simple cues (e.g., voice, movement, facial expression, gesture or recipients' name) for judgment formation, and they would not be thinking carefully.

This study is based on ELM, and we focus on examining and analyzing the factors, which impact trust and intention on the central route and peripheral route. The factors are information search, explanation facility, cognitive effort and satisfaction in the central route; peripheral route include anthropomorphic, telepresence and social presence. Consumers can trust in RAs through rational thinking and feeling, and they conceptualize that trust contains cognitive trust and emotional trust [9][10]. Next we will infer and explain for the two paths.

### Central Route

Consumers think rationally on the central route. Information search and explanation facility are belong to central cue. RAs can reduce consumers' cognitive effort and increase the degree of satisfaction by offering these, and lead to higher cognitive trust and intention to adopt. We propose the hypotheses on the central route as following:

### The relationship between information search, explanation facilities and cognitive effort

Level of information search has been frequently used as an indicator and measure of effort. Explanation facilities serve to clarify and make something understandable with a view to adjusting a misunderstanding or reconciling differences. For instance, explanations provide information such as why certain questions were asked by the system, what some terms mean, how

conclusions were reached, and why other conclusions were not reached [8]. The cognitive effort refers to the psychological costs users perceived to obtain and process information that enable them to arrive at a decision [19].

It's important to help consumers find the appropriate products by RAs [3][20][30]. Most consumers likely spend less effort or force to find appropriate products, and they also hope that through someone's help to complete the tasks. RAs can explain to the consumers the recommended products for why and how by explanation facilities, making them understand the details of products more quickly. RAs require a lot of information as the database for decisions making. Information search can make consumers know that how much data required to be picked. Hence, we expect that consumers' cognitive effort would be reduced when RAs offer information search and explanation facilities.

*H1: Consumers using RAs feel that more cognitive effort saving with information search and explanation facilities.*

*H1a: Consumers using RAs feel that more cognitive effort saving with information search.*

*H1b: Consumers using RAs feel that more cognitive effort saving with explanation facilities.*

### **The relationship between cognitive effort saving and satisfaction**

It's very important when consumers use RAs for making decision [32]. The higher consumers' perception of the effort saved by decision aids, the higher is their satisfaction with the decision process [3]. Moreover, RAs enable consumers to use more information in their decision making to prevent information overload and the trouble of filtering information. All else being equal, consumers feel more satisfied with the information search and decision-making process under the following two conditions [26]: (1) the costs of the process decrease and/or (2) the benefits increase. Therefore, we expect that consumers' perceptions of cognitive effort are lower, and then their satisfaction with decision process is higher.

*H2: Consumers who use RAs to find the products, the higher their perception of the effort saved by RAs, the higher is their satisfaction with the decision process.*

### **The relationship between satisfaction and cognitive effort saving**

Cognitive trust is defined as a trustor's rational expectations that a trustee will have the necessary attributes to be relied upon [9][10]. According to [10], we also did not include cognitive trust in benevolence, because in the

context of RA adoption, the RA's competence and integrity are the key indicators of cognitive trusting beliefs. Trust in an RA's benevolence may be difficult to assess since the trustor has to form the beliefs that RAs can exhibit care and goodwill that go beyond the predetermined tasks of giving competent and honest advice, tasks RAs are designed to do.

Consumers would rationally expect that the process of finding the product is match for their satisfactions. Thus, consumers will be going to complete the tasks with RAs.

*H3: Consumers who use RAs to find the products, consumers are satisfaction with RAs will increase cognitive trust in RAs.*

### **The relationship between cognitive trust and intention to adopt**

RAs adoption will largely rely on customer trust in the RAs. Trust is an important variable for the consumers' intention to adopt RAs. It impacts on their intention and perceive usefulness positively [29].

According to [9][10], cognitive trust has a direct impact on the intention to adopt RAs as a decision aid. Consumers' dependence is lower during the initial interact with RAs, because they would carefully verify that the recommended product and the explanation are correct and meet their requirements before making decision. Therefore, they are more willing to rely on RAs as a decision aid when RAs could provide correct and clear information about products.

*H4: Consumers who use RAs to find the products, cognitive trust will increase the intention to use RAs.*

### **Peripheral Route**

When consumers receive the messages through the peripheral route, they will elaborate from affective perspective. Consumers' degree of telepresence would be impacted by anthropomorphic interface. And consumers can feel more social presence when they interact with RAs, which are similar to real person. We propose the hypotheses on the peripheral route as following:

### **The relationship between anthropomorphic and telepresence**

The interface of RAs exhibits non-verbal cues (e.g., eyes contact, gazing, expressive facial expressions, etc.) when consumers interact with RAs. All of these contribute to feelings of social interactions between consumers and RAs, and we can design various interface to express the degree of difference in anthropomorphic. RAs are similar or familiar to the behavior of human beings, making consumers feel human-like in the high

degree of anthropomorphic interface. Relatively, consumers can only imagine on their own when the low degree of anthropomorphic interface is employed.

Telepresence can be generalized as a sense of transportation to any "space" created by media. Vividness and interactivity of website are factor for telepresence. The high degree of anthropomorphic interface could simulate the real situations to promote vividness and interactivity with non-verbal cues. Consumers' telepresence are affected by these factors, and they would think that RAs are usefulness.

*H5: Consumers who use RAs to find the products, consumers perceive greater telepresence when interaction with the high degree of anthropomorphic interface.*

### **The relationship between telepresence and social presence**

According to the theory of Social Presence [25], social presence was developed to measure people's subjective perceptions of other people when the communication is mediated by communication medium. It describes the extent to which a medium is perceived as sociable, warm, sensitive, personal, or intimate when it is used to interact with others.

Consumers regard RAs as decision aids is equal to their interaction with the real salesperson as well. Consumers would immerse in the virtual environment when they communicate with RAs through the high degree of anthropomorphic interface. Therefore, the higher the sense of "being there" in the Web site, the higher the degree of salience of the communication participant in the mediated environment [4].

*H6: Consumers who use RAs to find the products, consumers perceive greater social presence when interaction with the high degree of telepresence.*

### **The relationship between social presence and emotional trust**

Komiak and Benbasat [9][10] conceptualize trust, including trust in IT, as a combination of cognitive trust and emotional trust. Cognitive trust is based on reasoning and emotional trust is feeling. Emotional trust and cognitive trust are different, emotional trust is defined as the extent to which one feels secure and comfortable about relying on the trustee. There is a personalized connection between RAs and consumers. Therefore, we can cut down both of their psychological distance through enhancing consumers' social presence. Let consumers think that regarding RAs as decision aids is security and reliable [9][10].

*H7: Consumers who use RAs to find the products, consumers perceive that greater social*

*presence will increase their emotional trust in RAs.*

### **The relationship between emotional trust and intention to adopt**

The relationships between people are based on mutual interaction. Consumers' interaction with RAs is belonging to social relationships. Consumers have different feelings for the reasons. For example, consumers may feel the interface is good-looking or beautiful. And RAs can convey a perception of safety and comfort, making consumers feel that RAs are reliable. Therefore, they are willing to let RAs narrow down the choices that they will then evaluate to make a purchase decision [10]. The high level of anthropomorphic RAs will increase consumers trust in RAs [21][22]. The emotional trust will increase the customer's intention to adopt as a decision aid [9][10].

*H8: Consumers who use RAs to find the products, consumers perceive that greater emotional trust will increase their intention to adopt RAs as decision aids.*

### **The relationship between cognitive trust and emotional trust**

The relationships among cognitive trust, emotional trust, and intention to adopt fit well with the belief-attitude-intention framework suggested by TRA (Theory of Reasoned Action) [10]. TRA, a person's attitude toward performing a given behavior is the affective evaluation of the total effects of his or her beliefs that performing the behavior will lead to certain consequences and subsequent evaluation of those consequences. This attitude is a major determinant of the person's intention to perform the behavior in question [6]. In the context of RA adoption, a high level of cognitive trust in an RA's competence means that the customer believes that relying on the RA will generate well-customized recommendations. The customer holding such beliefs is likely to have stronger feelings of security and comfort about relying on the RA for his or her decision making [10].

*H9: Consumers who use RAs to find the products, consumers perceive that greater cognitive trust will increase their emotional trust.*

### **The relationship between expertise and information process**

According to ELM, persons gather information through two kinds of routes, such as the central and peripheral route [18]. It's based on the moderating of ability and motivation for elaboration. Compare to experts, the extent to which the consumer has experience with similar purchase decisions or has formal training involving

particular products affects the relative usefulness of the various types of decision aids. [15] suggest that experts are more likely to take the central route to persuasion because their likelihood of cognitive elaboration is higher. Novices are more likely to take the peripheral route to persuasion.

*H10: The degree of consumers' expertise will affect their information process routes.*

*H10a: Experts' intention to adopt RAs as decision aids is affected by their cognitive trust in RAs (central route).*

*H10b: Novices' intention to adopt RAs as decision aids is affected by their emotional trust in RAs (peripheral route).*

Summary, we utilize the research model shown in Figure 1, following the two sections to discuss the hypotheses. First is the central route. Second is peripheral route.

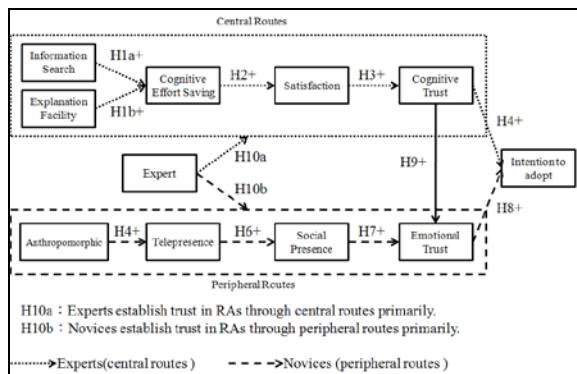


Figure 2. Research model.

## Research Method

### Experimental Design

A laboratory experiment was designed to examine the front end of our research model. We manipulate the multiple variables to design a website of RA in the internet environment. Let subjects use the website to complete the online questionnaires.

A 2x2x2 full factorial design was employed using all eight combinations of the three variables: (1) the presence or absence of a human face, (2) the presence or absence of explanation facilities and (3) the presence or absence of information search. To implement the treatments, we designed six interfaces for the same recommendation agent.

The RA was similar to those used in other studies [31] and in leading commercial applications (e.g., MyProductAdvisor.com).

According to [29], we developed recommendation agent that provides shopping advice for digital cameras. Because the attributes of digital cameras are complex and the product life cycle is pretty short. Besides, there are various choices in the market.

The experiment proceeded as follows. First, subjects had to complete a questionnaire about their familiar with digital cameras, and then they were randomly assigned to one of the eight groups. Second, we asked subjects to choose a digital camera for a good friend. Finally, subjects were asked to complete a questionnaire which included measures of all dependent variables.

### Measures

This study used validated scales for all dependent variables, with minor changes on wording. The questionnaires include two sections: (1) subjects were classified as expert or novice consumer by their scores on 15 true-false items that were based on information from magazine "PCDIY". The answers that were judged correct were given a score of "1" and those that were incorrect were assigned a score of "0" and (2) according to the research model, the measures of these variables are as following: (a) central route, (b) peripheral route and (c) intention to adopt. All were measured by 5-point Likert scales and shown in Table 1.

Table 1. Measurement Items.

	Construct	Item	Source
Central route	Cognitive Effort Saving	5	Bechwati and Xia (2003); Pu and Chen (2006)
	Satisfaction	4	Bechwati and Xia (2003)
	Cognitive Trust	5	Komiak and Benbasat (2006)
Peripheral route	Telepresence	9	Qiu and Benbasat (2005)
	Social Presence	5	Qiu and Benbasat (2009)
	Emotional Trust	3	Komiak and Benbasat (2006)
Intention to adopt	Intention to adopt	5	Al-Natour et al. (2008)

### Data Collection

A total of 420 participants participated in this study, which corresponds to at least 30 subjects per group. Participants are students or staff members recruited through online and offline advertisements in Chang Gung University. The information about experiment was posted on the discussion board of Bulletin Board System (BBS).

In order to encourage the participants to join the experiment, we provided prizes through a draw from each group. The experiment took about 20 to 30 minutes. The environment of website is Asp.Net of Microsoft, and the programming language is C# and HTML. Besides, the database system is SQL Server 2005 of Microsoft. To avoid the participants

who didn't select the options for necessary, we also make a reminder to warn them. During the experiment, we asked subjects follow the buttons, which were put into the website by us, doing the experiment. And browser was presented in full screen and the function of "previous" was canceled.

### Data Analysis Results

After the experiments, we filtered unusable returns, 302 questionnaires were usable for data analysis. Of the 302 participants, there were 254 undergraduate students and 48 graduate students. The male of respondents is around 45%, and female is 55%. For the causal model, we used the variance-based partial least squares (PLS) tool so as to simultaneously examine the structural component and the measurement component in one model.

### Reliability and Validity

Construct reliability was examined by Cronbach's  $\alpha$  and composite reliability. All constructs met the benchmark of acceptable reliability ( $\alpha > 0.70$ ). Convergent validity was examined by the average variance extracted (AVE) for each construct. Fornell and Larcker [7] suggested that the AVE from a construct should exceed 0.5. As shown in Table 2, all constructs satisfied this criterion. Discriminate validity was examined by a construct should share more variance with its own measures than it shares with other constructs in a model.

Table 2. Construct Reliability

	Mean	Standard Deviation	Composite Reliability	Cronbach's $\alpha$
CE	3.58	0.94	0.91	0.86
Sat	3.51	0.92	0.91	0.87
CT	3.72	0.72	0.84	0.76
TP	2.72	0.91	0.86	0.79
SP	2.72	0.91	0.91	0.88
ET	3.21	0.85	0.93	0.88
Int	3.38	0.93	0.95	0.94

PS. CE: Cognitive Effort Saving, Sat: Satisfaction, CT: Cognitive Trust, Int: Intention to adopt, TP: Telepresence, SP: Social Presence, ET: Emotional Trust.

As shown in Table 3, the square roots of the AVE were greater than the correlations between the construct with other constructs.

Table 3. AVE and correlation coefficient.

	AVE	CE	Sat	CT	Int	TP	SP	ET
CE	0.71	<b>0.84</b>						
Sat	0.72	0.78	<b>0.85</b>					
CT	0.52	0.49	0.54	<b>0.72</b>				
Int	0.55	0.70	0.66	0.55	<b>0.89</b>			

TP	0.67	0.25	0.21	0.18	0.29	<b>0.74</b>		
SP	0.81	0.26	0.29	0.24	0.38	0.62	<b>0.82</b>	
ET	0.80	0.60	0.57	0.50	0.73	0.25	0.30	<b>0.90</b>

PS. The scores (in bold) in the diagonal are square roots of AVEs; the lower triangle represents the correlations between constructs.

### Hypotheses Testing

The result of hypotheses testing is presented in figure 2. The result shows that all hypotheses are statistically supported except H5, which indicates that interface of RAs with anthropomorphic is not be significantly related to consumers' telepresence. Overall, the degree of explained variance by the model in terms of  $R^2$  approximately is 61% for satisfaction, 28% for cognitive trust, 58% for intention, 39% for social presence, 29% for emotional trust. The  $R^2$  of Cognitive effort saving is 2%, and 0.2% for telepresence.

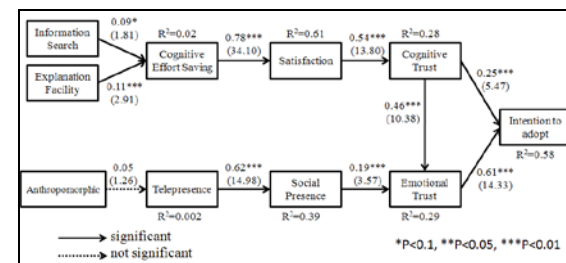


Figure 2. PLS analysis of all sample.

From figure 2 and figure 3, we can find that information search and explanation facility don't significantly influence cognitive effort saving for experts and novices. Besides, anthropomorphic is not related to telepresence. However, experts could establish their trust in RAs form central route. So, the hypothesis H10a is supported. But, novices would establish their trust in RAs from central route and peripheral route simultaneously. Therefore, the hypothesis H10b is not supported.

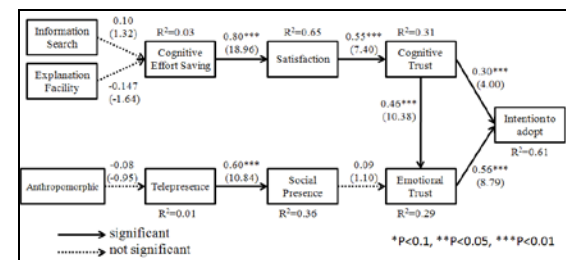


Figure 3. PLS analysis of experts.

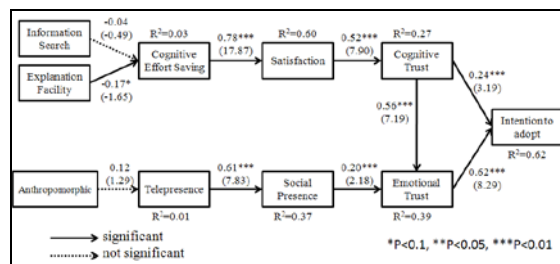


Figure 4. PLS analysis of novices.

## Conclusion

### Findings

This study investigates the influence on antecedents of consumers trusting RAs in different ways according to ELM. The findings show that and contribution can be explained as follow.

First, explanation facility and information search positively affect consumers' cognitive effort saving for experts and novices is not supported. This maybe expert who have much knowledge with the product, and they still could construct what they need without these information. Besides, novices might think that the information of explanation facility is limited on the web of experiment. This information can't be completely correct meaning of expression for them. However, explanation facility and information search still have positive effect on cognitive effort saving for general customers.

Second, anthropomorphic interface of RA doesn't have positive relationship with telepresence. We conclude that consumers may care more about utility compare to the interface of the simulation RA system when they initially use it. In addition, they may more concern about the information of products instead of interface when using the simulation system. It might be that consumers could get product-related information so easy that they ignore the real explanation video.

Third, consumers response to different motivation and ability, experts and novices, differed ways with regard to establish trust in RAs. According to the result, experts would establish trust in RAs from central route. Whereas, novices not only through central route but also peripheral route to establish their trust in RAs. Even the result is different from our exception, but still consistent with the literature (e.g., [15]).

### Academic Implication

This study used ELM to investigate the factors which influences of consumers' trust in RAs, and consumers were divided into experts and novices based on their characteristics. In addition to ELM, we also combined with other constructs (e.g. cognitive effort, satisfaction, telepresence, social presence, trust and intention to adopt) and extend a new research topic from consumers' point of view. For future researchers to follow the concept of this

study, further reinforcement, and make it more comprehensive framework

### Managerial Implication

From practitioner's perspective, we must pay more attention to consumers' cognitive effort and satisfaction when they are using RAs. In addition to the functions of RAs, we should focus on emotions conveyed by RAs. Finally, consumers' expertise is important, we must design different RAs to convince consumers. Further, we hope to increase their intention to adopt recommendation of RAs.

### Limitations

First, our sample was composed only of undergraduate students. Thus, future research should include participants within a more diverse age range. Second, this study was conducted with regard to digital cameras. Third, other types of RAs are worth to explore too.

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