The Impact of Internalization and Familiarity
On Trust and Adoption of Recommendation Agents

Key Words: Electronic Commerce, Trust, Customer Trust, Computer Agent, Intelligent Agent, Recommendation Agent, Adoption, Delegation, Decision Aid, Internalization, Familiarity

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Abstract

We postulate that the relationship between a customer and a recommendation agent (RA) in agent-mediated electronic commerce will affect customer trust in an RA and RA adoption. The relationship between a customer and an RA is a relationship of representation and delegation, which is personal and close. Our research model conceptualizes that both internalization and familiarity will affect customer trust in an RA (including both cognitive trust and emotional trust), and that customer trust in an RA will affect the intentions to adopt an RA as a delegated agent or as a decision aid. Internalization refers to a customer’s perception of how well an RA understands and represents her real needs. New measures of cognitive trust, emotional trust, the intention to adopt an RA as a delegated agent, and the intention to adopt an RA as a decision aid have been developed. The empirical study finds that internalization significantly and positively affects both cognitive trust and emotional trust in an RA. We are surprised to find that familiarity decreases emotional trust in an RA, and that it does not significantly influence cognitive trust in an RA. We also observe that both cognitive trust and emotional trust in an RA significantly and positively affect the intention to adopt an RA as a delegated agent or as a decision aid. Finally, it is interesting to learn that emotional trust fully mediates the impact of cognitive trust on the intention to adopt an RA as a delegated agent, and that emotional trust partially mediates the impact of cognitive trust on the intention to adopt an RA as a decision aid.
1. Introduction

A recommendation agent (RA) is an intelligent computer agent who gives an online customer the advice about what to buy (product-brokering) or where to buy (company-brokering) based on her personal preferences and needs (Maes, Guttman et al. 1999; Ansari, Essegaier et al. 2000). This paper focuses on the product-brokering RA.

Researchers have suggested that the use of a product-brokering RA in electronic commerce can reduce transaction costs, reduce effort, and improve the quality of decision-making for a customer (Haubl and Trifts, 2000; Lynch and Ariely, 2000). Given the very large number of online companies and the sheer number of product offerings in each online company (e.g., millions of books in Amazon.com), personalized computer agents (e.g., RA) will help to reduce search complexity (Chiasson, Hawkey et al. 2002) and information overload (Nwana et al. 1998). However, a customer needs to build enough trust in an RA before she is willing to use or even delegate her decision-making to an RA (Nwana et al. 1998). It is still not evident how a customer will adopt an RA, how much and what kind of trust will be needed for a customer to adopt an RA, and what kind of design will facilitate trust-building in an RA. In addition, most prior research focuses on RA design from the technical perspective (Zacha, Moukas et al. 1999; Ansari, Essegaier et al. 2000). This paper adds to the body of knowledge by focusing on the design of, the trust in, and the adoption of an RA from the perspective of an online customer.

An online customer may shop online without or with an RA. In web-mediated ecommerce, a customer will browse the websites of a few companies, collect and process
product information, and then make a purchasing decision herself. In agent-mediated ecommerce, a customer will give instructions to an RA, which will take the customer’s personal preferences and needs as its own, when it processes product information and makes purchasing decisions on behalf of the customer. Therefore, the nature of the relationship between a customer and a website is different from the nature of the relationship between a customer and an RA. A personal and close relationship exists between a customer and her RA, no matter if the RA is owned by a company’s website (e.g., the RA at www.Amazon.com), by a third party (e.g., the RA at www.shopping.com), or by a customer. The RA will represent this particular customer, and the customer will delegate various responsibilities to the RA. In contrast, the relationship between a customer and a company’s website is neither personal nor close, because there is neither representation nor delegation in their relationship. Such a change in the nature of the relationship will transform the design requirements for an RA, the nature of customer trust in the RA, and the process of RA adoption. The overall research goal is to improve our understanding of these transformations.

The research questions of this study include:

- What is customer trust in a Recommendation Agent (RA)? How is it measured?
- What is the impact of the level of internalization on trust in an RA?
  
  Internalization refers to a customer’s perception of how well an RA can understand and represent the customer’s real needs.
- What is the impact of the degree of familiarity on trust in an RA? Familiarity refers to a customer’s knowledge with how an RA derives its recommendation.
What is the impact of trust in an RA on a customer’s intentions to adopt an RA as a decision aid or as a delegated agent?

This paper is organized as follows: Section 2 presents the research model and the hypotheses to be tested. Section 3 explains research method and measure development. Section 4 reports and discusses the results of an experiment. The final section discusses the implications of the findings.

2. The Research Model and Hypotheses

By drawing on prior literature in the fields of KBS/ES (knowledge-based systems / expert systems), marketing, and sociology, factors are organized into the research model shown in Figure 1, which contains four constructs at three levels. Internalization and Familiarity stand for the mutual understanding between a customer and an RA. Both Internalization and Familiarity are expected to affect both cognitive trust and emotional trust in an RA, which in turn will influence a customer’s intentions to adopt an RA as a delegated agent or as a decision aid.

![Figure 1: The Research Model](image)

In this model, we differentiate between cognitive trust and emotional trust, because we conceptualize that cognitive trust is the *rational assessments* of an RA’s competence,
benevolence, and integrity, and that emotional trust is a customer’s feelings of security and comfort about relying on an RA. Cognitive trust mainly deals with a customer’s awareness of the known (what a customer knows for sure about an RA). Emotional trust mainly deals with a customer’s awareness of the unknown (a customer realizes that she does not know something about an RA). Prior research on customer trust in ecommerce is predominantly concerned with cognitive trust, whereas it largely ignores emotional trust. This study will investigate both. We propose that emotional trust should be included in trust research, especially in the context of ecommerce, because it is more likely for a customer to be aware of the unknown in ecommerce than in traditional commerce. This is due to the spatial and temporal separation imposed between buyers and sellers in ecommerce (Brynjolfsson and Smith 2000).

For the antecedents of trust in an RA, testing the impact of internalization on trust in an RA is a novel approach for two reasons. First, prior research on interpersonal trust (MacNeil 1980; Doney and Cannon 1997) suggests that mutual understanding between two people (e.g., a customer and a salesperson) will improve one person’s trust in the other (e.g., customer trust in a salesperson). However, while an RA is a virtual salesperson, it is also a computer agent. It is not clear whether the reported relationship between mutual understanding and trust will hold in the context of customer trust in an RA. Second, prior research on intelligent agents (e.g., KBS/ES/RA) focuses on how to design an RA to technically do its job, such as filtering products (Maes, Guttman et al. 1999; Ansari, Essegaier et al. 2000) and how to allow a customer to understand the agent (Gregor and Benbasat 1999; Mao and Benbasat 2000). These ignore the issues of how to
design an RA that can understand and represent a customer better. The model in Figure 1 emphasizes the need to design an RA that understands and represents a customer’s real needs.

This study also differs from the prior models on IT adoption, because it differentiates between the intention to adopt an RA as a decision aid and the intention to adopt an RA as a delegated agent. Our review of prior research has not found any study that has measured or tested the intention to adopt a computer agent as a delegated agent. However, given the agent role that an RA plays, a customer will at least partially delegate information processing or decision making to it. Therefore, we should investigate the intention to adopt an RA as a delegated agent in agent-mediated ecommerce.

The following subsections discuss each of the constructs depicted in Figure 1. Each is explained and hypotheses are developed to show the expected relationships among the constructs. Measure development for each construct is discussed within section 3.

2.1 Internalization: Low-internalization RA vs. High-internalization RA

Internalization refers to a customer’s perception of how well an RA understands and represents her real needs. We choose to examine internalization, because internalization is an important feature of the agent relationship between a customer and her RA, and it deserves further research. The agent relationship between a customer and her RA is different from the agent relationship between two people. When the agent is a computer agent (e.g. RA) instead of a person, the customer may have higher concern about how
well a computer agent really understands and represents her real needs. This is because a computer agent usually is not as understanding as a person is. Internalization represents the part of RA intelligence about the customer. Prior research is primarily concerned with how to design a computer agent/website/KBS/ES so that a customer/user can understand the computer agent/website/KBS/ES better (Gregor and Benbasat 1999; Mao and Benbasat 2000). In contrast, we suggest that the other direction -- how to design a customer agent in order to make it understand and represent an individual customer better (i.e. internalization) -- will also be important for the design and development of customer agents. Great efforts will be needed to design and build an RA with high internalization. If our study can provide the evidence for the positive impact of RA internalization on customer trust in an RA and on RA adoption, then the results can provide some justification for our future efforts on such design and development.

We would like to clarify that internalization is not the same as personalization. If an RA asks a customer about her individual preferences of product attributes, and uses this basis to provide the customized advice, then the RA is personalized. However, personalization is not the same as internalization. The key of internalization is the agent’s ability to completely understand and represent the particular customer’s real needs. The questions asked by the RA may or may not be enough to capture what the customer really wants. Therefore, the personalized RA can be either a high-internalization RA or a low-internalization RA. For example, if the customer is unable to express her real needs (e.g., playing computer games on a notebook computer) into the appropriate product attributes (e.g., at least 526M RAM and active matrix screen), then it is personalization, but not
internalization. An RA with high internalization should be able to help the customer to convert her real needs into the appropriate product attributes, and the RA’s reasoning process should resemble the particular customer’s reasoning process for purchase decision-making.

Prior research on customer trust in computer agents used in agent-mediated ecommerce is scarce. Nwana et al. (1998) comment on the issues, including trust in computer agents, in agent-mediated ecommerce. They suggest that in order for the owner of a computer agent to trust it, the owner must be assured that the agent will not compromise private information and deviate beyond its constraints. A computer agent should be a reliable system that does not act unreasonably, and the owner should always have the right to approve the purchases or agreements initiated by the agent. In addition, the only empirical study we have found on customer trust in recommendation agents is written by Urban, Sultan et al. (1999). Urban et al. (1999) reported that an RA (called a virtual personal advisor) could gain as much trust as dealers or salespeople may gain in traditional commerce. They did not examine any antecedent or consequence for customer trust in an RA. A review of prior studies has not found any research that uses internalization, or personalization, as one antecedent for trust, although there is some prior research on personalization in ecommerce concerning the technical design of personalized technologies (Fink and Kobsa 2000; Kobsa, Koenemann et al. 2001; Ardissono, Goy et al. 2002).
We mainly draw on prior literature on customer trust in salespeople to develop our hypothesis about the impact of internalization on trust in an RA, because an online customer tends to view an RA as a virtual online salesperson. We expect that higher internalization implies a higher perceived similarity between a customer and an RA in terms of goals, because the essence of internalization is that the RA will take a customer’s real needs and preferences as its own. In the context of interpersonal trust, trust can be developed when two parties share a variety of experiences (Doney and Cannon 1997) or values/norms (MacNeil 1980). A person will have trust in people holding similar salient values (Fukuyama 1995; Siegrist, Cvetkovich et al. 2000; Armstrong and Yee 2001). When a customer perceives a high level of attention given by a salesperson, this will enhance her trust in the salesperson and lead to greater anticipation of future interactions (Ramsey and Sohi 1997). In agent-mediated ecommerce, an RA will help a customer to decide what and where to buy, just as an experienced salesperson will do in traditional commerce. Nass and Lee (2001) suggest that a person will treat a computer system in the same way as she will treat another person. Therefore, we expect that customer trust in a high-internalization RA will be greater.

In particular, we hypothesize that internalization will increase cognitive trust (please see the following subsection of customer trust for the definition,) because higher perceived internalization (also higher perceived similarity) will facilitate a customer’s rational interpretations of the features and actions of the RA. In addition, a customer may
interpret the RA’s higher internalization as its greater willingness and ability to take care of her needs.

We also hypothesize that emotional trust in a high-internalization RA will be greater, because higher perceived internalization (also higher perceived similarity) will reduce the customer’s worrying about the unknown. In addition, similarity leads to attraction (Crosby, Evans et al. 1990; Siegrist, Cvetkovich et al. 2000). Attraction (i.e. a salesperson’s likeability) leads to customer trust in that salesperson (Swan, Trawick et al. 1988; Doney and Cannon 1997; Nicholson, Compeau et al. 2001). Since an RA gives shopping recommendations just as an experienced salesperson does, we expect:

**H1a**: Cognitive trust in a high-internalization RA will be greater than cognitive trust in a low-internalization RA.

**H1b**: Emotional trust in a high-internalization RA will be greater than emotional trust in a low-internalization RA.

### 2.2 Familiarity: Initial interaction and repeated interactions

*Familiarity* refers to a customer’s knowledge of how an RA derives its recommendation. It represents how well a customer understands the characteristics and the actions of an RA. A customer’s familiarity with the RA is expected to increase from initial interaction to repeated interactions.

We will examine familiarity for three reasons. First, familiarity is an important feature of the agent relationship between a customer and her RA. It represents how well the
customer knows about how the agent does its job (giving product recommendations).

Second, prior research on the impact of familiarity on trust is controversial. Third, it is unclear if familiarity will have a different impact on cognitive trust versus emotional trust.

Regarding the impact of familiarity on trust, the results from prior research are quite controversial. Luhmann (1979) suggests that familiarity is the precondition of trust as well as distrust. Familiarity, itself, denotes reliable expectations, but it differentiates neither favorable nor unfavorable expectations. However, it is suggested that familiarity will build inter-firm trust (Gulati 1995), interpersonal relationship (Rempel, Holmes et al. 1985), and customer trust in a vendor in ecommerce (Gefen 2000). Prior research shows that through repeatedly making promises and delivering on them, a salesperson develops the confidence of a purchaser (Swan, Trawick et al. 1985; Doyle and Roth 1992). In contrast, some studies suggest that trust in the initial interaction could be high (Kramer 1994; McKnight, Cummings et al. 1998). These results tend to disagree with the viewpoint that trust grows over time (i.e. familiarity builds trust).

In the context of RA use in ecommerce, we expect that familiarity will improve trust in an RA for two reasons. First, the empirical evidences supporting the positive impact of familiarity on trust seems to be stronger than the evidences supporting the neutral or negative impact. Luhmann (1979), McKnight et al. (1998), and Kramer (1994) did not actually measure trust in the repeated interactions and compare it to trust in the initial interaction directly. Second, we expect that mutual understanding between a customer
and an RA will increase customer trust in the RA. Familiarity is a part of mutual understanding. Therefore, we hypothesize:

**H2a:** *Cognitive trust* in an RA will be *higher* after repeated interactions than cognitive trust after the initial interaction.

**H2b:** *Emotional trust* in an RA will be *higher* after repeated interactions than emotional trust after the initial interaction.

### 2.3 Customer Trust in an RA

**A proposed trust model**

Our proposed trust model differentiates between cognitive trust and emotional trust. The conceptual models of trust discussed in prior research (Mayer, Davis et al. 1995; McKnight and Chervany 2001; Morgan and Hunt 1994; Swan, Bowers et al. 1999) are concerned primarily with a customer’s *interpretation of reality* that provides rational reasons for trust (i.e. cognitive trust). We recognize that research on trust has already moved on from the rational choice model and allows for affective and moral bases of trust (Mayer, Davis et al. 1995; McAllister 1995) which is cognitive trust in a trustee’s benevolence and integrity. Cognitive trust in a trustee’s benevolence and integrity is based on a customer’s interpreting what she knows into her rational assessment of a trustee’s benevolence or integrity. However, any form of *interpretation* is limited, and interpretation alone is not enough to enable trust, because when a customer realizes that she lacks some knowledge about the trustee (i.e. the awareness of the unknown), she cannot interpret her awareness of the unknown into rational assessments of the trustee’s competence, benevolence, or integrity. Trust is more than cognition.
As suggested by Mollering (2001), “… it [trust] stands for a process in which we reach a point where our interpretations are accepted and our awareness of the unknown, unknowable and unresolved is suspended.” (p. 414). We think that a customer’s suspension of worrying about the unknown, instead of her suspension of the awareness of the unknown, is a necessary part of the trust-building process. A customer may still be aware of the unknown, but she can suspend worrying about it. For example, a customer is aware of “the unknown” about an RA when she can not understand the RA’s technical explanations for a product attribute. However, since the technical explanation looks professional and assuring, she may suspend her worrying about the unknown. She forms her trust based on her feelings. Such a process should be included as a part of her trust building, which is the building of emotional trust.

In addition, because RA’s are a new technology and the Internet shopping channel is “faceless”, this issue of suspending worry about the unknown becomes particularly important for customer trust research in agent-mediated ecommerce. We therefore propose a trust model to differentiate cognitive trust from emotional trust:

*Trust* in an RA is defined as a state of favorable expectation that an RA will have competence, benevolence, and integrity that can be relied upon in the future.

- **Cognitive trust** is a customer’s *rational assessments* that an RA will have the necessary competence, benevolence, and integrity to be relied upon in the future.

- **Emotional trust** is a customer’s *feelings* of security and comfort about relying on an RA. (This definition is adapted from “Affect” defined by Swan, et al. (1999))
We think that a customer will both think trust and feel trust. On one side, the customer will interpret her awareness of the known (i.e. what she knows about an RA) into rational reasons for trust. Her cognitive trust is the result of her accepting these reasons. A customer may also develop emotional trust on her awareness of the known, for instance, she may feel more secure about relying on a salesperson who looks serious and professional, or she will feel secure and comfortable if she rationally assesses that the RA has competence, benevolence, and integrity. On the other side, when a customer is aware of the unknown (i.e. she realizes what she does not know something about the RA), she will judge the RA based on her feelings of comfort and security. When such feelings are strong enough, or if her unknown can be resolved, the customer will suspend worrying about the unknown. Otherwise, her awareness of the unknown may lead to her worrying about the unknown, which then leads to the decrease of emotional trust.

This proposed model is different from McKnight and Chervany (2001)’s “Trusting Beliefs”. McKnight and Chervany (2001) define Trusting Beliefs as “one believes (and feels confident in believing) that the other person has one or more traits desirable to one in a situation in which negative consequences are possible” (p. 4). They did not differentiate between cognitive trust and emotional trust. In addition, the proposed model is based on prior research on emotional trust. Lewis et al (1985) conceptualize emotional trust as a strong positive affect about the trustee. However, Lewis and Weigert (1985)’s concept of emotional trust is easily confused with the concept of liking/affect. Liking/affect and trust are different concepts (Chaudhuri and Holbrook 2001).
Liking/affect is how a customer feels like an entity (a strong positive affect). It is possible for a customer to neither like nor dislike a salesperson but still feel secure and comfortable about relying on a salesperson for his shopping decision (i.e. emotional trust), because the salesperson sounds knowledgeable, confident, serious, and authoritative. Our definition of emotional trust is adapted from Swan et al’s concept of “affect” (Swan, Trawick et al. 1988; Swan, Bowers et al. 1999). They define affect as “feeling secure or insecure about relying on the salesperson” (p94). Our definition of emotional trust removes “the feeling or insecure” since we define trust as a state of “favorable” expectation. We expand the feelings from only “secure” to “secure and comfortable” and expand the scope of trustee from “salesperson” to an RA in an ecommerce setting. More importantly, Swan et al. did not explain why cognitive trust and affect are two components of customer trust in a salesperson. We justify this by linking cognitive trust and emotional trust to Mollering’s theory (2001).

The impact of trust on the intentions to adopt an RA

Customer trust in a computer agent is positively related to her willingness to delegate to the agent (Nwana, Rosenschein et al. 1998) and her compliance with the agent’s recommendation (Gregor and Benbasat 1999). However, the respective impact of cognitive trust and emotional trust in an RA on RA adoption is not clear. In addition, it is not clear whether emotional trust mediates the impact of cognitive trust on the adoption intention, or cognitive trust mediates the impact of emotional trust on the adoption intention, because the directional relationship between cognitive and emotion is complex. It is suggested that cognition and emotion affect each other (Lewis and Weigert 1985).
We expect that cognitive trust will affect emotional trust significantly more than emotional trust will affect cognitive trust. This is because it is more likely for a customer to feel comfortable and secure when she cognitively trusts the RA, but less likely for her to convert her feelings to rational assessments of the RA’s characteristics. Therefore, we expect that, regarding the intention to adopt an RA as a delegated agent,

**H3a:** *Cognitive* trust will *increase* the intention to adopt an RA as a delegated agent.

**H3b:** *Emotional* trust will *increase* the intention to adopt an RA as a delegated agent.

**H3c:** Emotional trust will *mediate* the impact of cognitive trust on the intention to adopt an RA as a delegated agent.

We hypothesize that, regarding the intention to adopt an RA as a decision aid,

**H3d:** *Cognitive* trust will *increase* the intention to adopt an RA as a decision aid.

**H3e:** *Emotional* trust will *increase* the intention to adopt an RA as a decision aid.

**H3f:** Emotional trust will *mediate* the impact of cognitive trust on the intention to adopt an RA as a decision aid.

2.4 Intention to Adopt an RA

We differentiate between two forms of RA adoption intentions: (1) the intention to adopt an RA as a delegated agent, and (2) the intention to adopt an RA as a decision aid.

*Customer intention to adopt an RA as a delegated agent* refers to the extent to which a customer is willing to let an RA make decisions about which product to buy on her behalf. *Customer intention to adopt an RA as a decision aid* refers to the extent to which a customer is willing to let an RA narrow down her choices. Based on the
recommendation made by the RA, the customer will process the product information and make purchasing decisions herself.

At the conceptual level, the intention to adopt an RA as a delegated agent and the intention to adopt an RA as a decision aid are related to each other, but they are different. They are related to each other for two reasons. First, using an RA as a delegated agent or as a decision aid are two forms of RA adoption. The first one contains a stronger commitment than the second. In addition, our research model conceptualizes that both intentions will share the same cause – customer trust in an RA. However, the two adoption intentions are different. If the intention to adopt an RA as a delegated agent is high, a customer may take an RA’s recommendation without examining the RA’s recommendation (including the RA’s explanations), and she will be happier when an RA recommends very few, even only one, product. In contrast, if the intention to adopt an RA as a decision aid is high, a customer will tend to carefully examine the RA’s recommendation (and explanations if available) before she makes her purchasing decision. She will also be happier when an RA recommends quite a few products so she will have a choice. Empirically, the factor analysis of the measures (see section 3 of research method) shows that the two adoption intentions are different factors. We expect that the two intentions to adopt an RA will be correlated to each other due to the shared cause, but the correlation coefficient would not be very high due to the different meanings between the two forms of RA adoption. We tested this point based on our experimental data.
Additionally, using an RA as a delegated agent is a stronger commitment than using an RA as a decision aid (Nwana, Rosenschein et al. 1998). Because we expect that a customer will be more conservative about letting others (e.g., RA) make decisions for her, although she may listen to others during the decision-making process.

**H4**: The intention to adopt an RA as a delegated agent will be lower than the intention to adopt an RA as decision aid.

### 3. Research Method

A laboratory experiment was conducted to test the research model. The experiment was a 2*2 between-subject full-factorial experimental design. Details concerning subjects, treatments, measures, and procedures are provided in the following subsections.

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#### 3.1 Subjects

All the 92 subjects were undergraduate or graduate students in a business school. These subjects felt comfortable using computers (6.44 on a 7-point scale) and shopping online (4.82). They spent average $371 on shopping online in year 2001. All subjects had made purchases within the past 6 months, planned to buy within the next 6 months, or were interested in buying at least one of the three products shopped in our experiment: notebook computer, desktop computer, and digital camera.
The incentives of participation included (a) $15 or (b) $10 plus one course credit. All the subjects were interested in buying the products in the experiment. In order to motivate the subjects to take the experiment as serious online shopping, we told the subjects beforehand that there would be a lucky drawing, in which one winner would get $400 refund for actually purchasing the product that she or he decided to buy during the experiment.

All the subjects volunteered to participate. They were randomly assigned to one of the four groups. Within the 23 subjects in each group, 11 subjects were asked to think aloud. Background checks show that there is no significant difference in terms of the general feelings about using computers or shopping online, and in terms of the four control variables (i.e. control propensity, trust propensity, preference for effort saving vs. decision quality, and product expertise). The measures of the four control variables are shown in Table 2 in the Appendix. Please also see the Appendix for the results of card sorting (Table 3) and reliability tests (Table 5) for these measures.

3.2 Independent Variable: Internalization

Two levels of internalization have been investigated: a high-internalization RA can understand and represent a customer’s real needs better than a low-internalization RA. In the experiment, we choose both RA’s from www.activebuyerguide.com. Both RA’s were constraint-satisfaction RA’s (Maes, Guttman et al. 1999; Ansari, Essegaier et al. 2000). Both provided the customer with the same product attributes for comparative specifications, the same explanations for each product attribute, and used the same
strategy to filter the products available over the Internet. However, the two RA’s were
different in terms of internalization. The low-internalization RA asked a customer to
make one selection from the specified levels for each product attribute. The high-
internalization RA asked a customer the same questions plus the importance of each
attribute. When a customer was still neither clear nor comfortable with the RA’s
explanations about product attributes, she could tell the RA how she was going to use the
product by answering a four-choice question written in natural English. The RA would
then suggest the appropriate attribute level, and the customer would have the right to
overwrite it.

A manipulation check for internalization was conducted. At the end of each experimental
session, after a subject had used one RA, she was showed the other RA, and was asked
three questions (7 point Likert questions):

(1) This RA understands my needs and preferences.
(2) This RA knows what I want.
(3) This RA takes my needs and preferences as its preferences.

The results show that the manipulation was successful (N=89, high-internalization RA
(5.85) vs. low-internalization RA (4.38). Paired samples t-test, 2 tailed, t=9.30,
p=0.00**).

3.3 Independent Variable: Familiarity

Two levels of familiarity have been examined: the initial interaction vs. repeated
interactions. According to the background check, none of the 92 subjects had prior use of
this RA before the experiment. The subjects in the initial interaction groups used one RA to shop for one product: a notebook computer. The subjects in the repeated interaction groups used the same RA to shop for three products: a notebook computer, a desktop PC, and a digital camera. These three products are similar products (all electronics) with the same level of complexity (the RA considers about 11 attributes for each product). For repeated interactions, we choose three because the pilot test showed that four interactions led to subject fatigue. We choose three instead of two because three interactions were enough for the subjects’ trust in the RA to reach a steady state level. In our experiment, after each subject finished shopping for one product, s/he was asked to answer one short question: “I trust this RA”. The t-test (t= 1.27, p=0.21, N=46, paired samples T-test, 2-tailed) shows that there was no significant difference between the answers after the second interaction (4.82) and those after the third interaction (5.02).

A manipulation check for familiarity was conducted. At the end of each experimental session, subjects answered the following question: “I am familiar with how this RA makes its recommendation” (1-7 point Likert question). The t-test result (p=0.02*) shows that the manipulation was successful (N=46, initial interaction (4.9) vs. repeated interactions (5.6)). In addition, the t-test result (p=0.20) shows that there was no significant difference between the degree of familiarity in initial-interaction groups (4.9) and the degree of familiarity after the first interaction in repeated-interactions groups (4.4).
3.4 Dependent Variables: Measure Development

We have developed the measures for (1) cognitive trust, (2) emotional trust, (3) the intention to adopt an RA as a delegated agent, and (4) the intention to adopt an RA as a decision aid by adopting the three-step method of instrument development (Moore and Benbasat 1991).

Step 1: Scale creation. The objective of step 1 was to ensure content validity. We created a pool of 36 items for customer trust by identifying items from existing items and by creating additional items, together with 6 items for the intention to adopt an RA.

Step 2: Scale development. There were three goals for this step: (1) to assess the construct validity, (2) to identify the items that might still be ambiguous, and (3) to reduce the number of items in each category. At this step, we conducted three-round card sorting -- a method proposed by Moore and Benbasat (1991). Each item was printed on one index card. The cards were shuffled into random order before a judge sorted the cards into categories independently from the other judges.

Round1 card sorting: To reduce the potential of interpretational confounding, six judges were not told what the underlying constructs were, but asked to classify the 36 items (customer trust in an RA) into several categories (the judge determines it), and to provide their own labels for the constructs. If their labels matched the item’s intent, then our confidence in the construct validity of the scale increased. The six judges were 4 graduate
students and two undergraduate students in a business school. The results showed that the subject could separate cognitive trust from emotional trust.

Round 2 card sorting: The goal was to test the convergent validity and discriminant validity of items within categories. At round two, six new judges were given the labels of categories (cognitive trust in competence, cognitive trust in benevolence, cognitive trust in integrity, emotional trust), then they sorted the 36 cards into each category. The six judges were five doctoral students plus one undergraduate student. If a number of items were consistently sorted into one category, then the items based on this category demonstrated convergent validity with this category and discriminant validity with the other categories.

Round 3 card sorting: We chose the 26 items measuring customer trust in an RA that survived the previous two rounds of card sorting, plus 6 items measuring the intentions to adopt an RA (Table 1 in the Appendix), plus 10 items measuring three control variables (control propensity, trust propensity, Preference for effort saving vs. decision quality; Table 2 in the Appendix), and then repeated round 2 card sorting. Inter-judge reliabilities were tested by calculating Cohen’s Kappa for each pair of judges and placement ratios (Moore and Benbasat, 1991). The results of round 3 cards sorting (Table 3 in the Appendix) showed the good construct validity of the measures.

Step 3: Scale testing. The purpose of this step was to assess the reliability and validity of the scale. We conducted factorial analysis to validate the four constructs: (1) cognitive
trust, (2) emotional trust, (3) the intention to adopt an RA as a delegated agent, and (4) the intention to adopt an RA as a decision aid. In total 162 subjects tried a simple recommendation agent, and then filled in a questionnaire, which contained the 32 items (Table 1 in the Appendix). The order of items was shuffled on purpose in order to separate the items within the same category. Based on the results, 4 items were deleted.

The results of factor analysis (Table 4 in the Appendix) showed that the four constructs above were loaded separately, which means they were different constructs. We noted that within cognitive trust in an RA, the subjects could separate cognitive trust into two subgroups: a) cognitive trust in an RA’s competence and cognitive trust in an RA’s benevolence, and b) cognitive trust in an RA’s integrity. We interviewed six subjects to find out why they mixed cognitive trust in an RA’s competence with cognitive trust in an RA’s benevolence. The interview results showed that the RA used in the pilot asked the subjects very simple questions about a music CD without providing any explanation or any tip for CD selection. The RA was too simple to make the subjects feel that the RA was a virtual salesperson who was providing recommendations on CD. Subjects thought that the RA was computer software, and not a person. The subjects wondered how an RA could have benevolence, although they understood that the RA could have integrity.

Finally, we decided to measure cognitive trust in an RA as cognitive trust in an RA’s competence, benevolence, and integrity (Table 1 in the Appendix) for the following reasons. First, the RA used in experiment was more mature than the RA used in the pilot test, in terms of product expertise, explanations, and preference elicitation. Second, in the
tutorial and in the information sheet for the experiment, we informed the subjects that a computer company had developed this RA as “a virtual salesperson”. We asked the subjects to compare the RA in the experiment to a salesperson in real life. When the subjects began to view the RA as a virtual salesperson, they would understand that the RA might have competence, benevolence, and integrity. Third, the card sorting results showed that the subjects could separate cognitive trust in competence, benevolence, and integrity. Therefore, we measured cognitive trust in an RA as the average of cognitive trust in competence, benevolence, and integrity, which were measured by using the scales listed in Table 1 in the Appendix.

In addition to factor analysis and the interviews, we also did reliability tests. The results (Table 5) showed the good reliability for the measures.

3.5 Experimental Procedures

Each subject took part in the experiment individually. The procedures were as follows:

(1) Completed consent form and background questionnaire.

(2) By taking a tutorial, a subject learned about how to use an RA.

(3) Read the information sheet which stated that the subject would test a new RA. A computer company had developed the RA as a virtual personalized salesperson, and the company hoped that the subject would buy and own the RA.

(4) Interacted with an RA. The subjects in group 1 and 2 used low-internalization RA, while the subjects in group 3 and 4 used high-internalization RA. The subjects in group 1
and 3 used an RA to shop for a notebook computer only. The subjects in group 2 and 4 used an RA to shop for a notebook computer, a desktop PC, and a digital camera.

(5) Completed a questionnaire about trust, the intentions to adopt an RA, and control variables.

(6) Conducted manipulation checking. Each subject used the other RA, and answered the manipulation-checking questions about internalization.

4. Results and Discussions

This section reports the results of the experiment. The descriptive statistics of customer trust are shown in Table 4.1. The reliability tests for the measures are shown in Table 5 in the Appendix. The following subsections present and discuss the results of hypotheses tests.

<table>
<thead>
<tr>
<th>Cognitive Trust</th>
<th>Initial</th>
<th>Repeated</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low internalization</td>
<td>5.03 (0.25)</td>
<td>5.10 (0.15)</td>
<td>5.07</td>
</tr>
<tr>
<td>High internalization</td>
<td>5.82 (0.18)</td>
<td>5.32 (0.21)</td>
<td>5.57</td>
</tr>
<tr>
<td>Average</td>
<td>5.42</td>
<td>5.21</td>
<td>5.32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Emotional Trust</th>
<th>Initial</th>
<th>Repeated</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low internalization</td>
<td>4.66 (0.26)</td>
<td>4.60 (0.18)</td>
<td>4.63</td>
</tr>
<tr>
<td>High internalization</td>
<td>5.57 (0.22)</td>
<td>4.75 (0.20)</td>
<td>5.16</td>
</tr>
<tr>
<td>Average</td>
<td>5.12</td>
<td>4.68</td>
<td>4.90</td>
</tr>
</tbody>
</table>

Note: the numbers are reported in the format of mean (standard error).
4.1 H1 and H2: Antecedents of customer trust in an RA

The means of cognitive trust and emotional trust are shown in Table 4.1. The ANOVA analysis supports H1, which indicates that internalization significantly and positively affects cognitive trust in an RA (Table 4.2) and emotional trust in an RA (Table 4.3).

However, the result for H2 test is surprising. H2 hypothesizes that familiarity will increase both cognitive trust and emotional trust, while the results show that familiarity decreases emotional trust in an RA (Table 4.2), and familiarity does not significantly affect cognitive trust in an RA (Table 4.3).

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1</td>
<td>2602.01</td>
<td>2791.83</td>
<td>0.00</td>
</tr>
<tr>
<td>INTERNAL</td>
<td>1</td>
<td>5.88</td>
<td>6.30</td>
<td>0.01*</td>
</tr>
<tr>
<td>FAMILIAR</td>
<td>1</td>
<td>1.00</td>
<td>1.07</td>
<td>0.30</td>
</tr>
<tr>
<td>INTERNAL * FAMILIAR</td>
<td>1</td>
<td>1.86</td>
<td>2.00</td>
<td>0.16</td>
</tr>
<tr>
<td>Error</td>
<td>88</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R Squared = 0.10

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1</td>
<td>2206.47</td>
<td>2046.54</td>
<td>0.00</td>
</tr>
<tr>
<td>INTERNAL</td>
<td>1</td>
<td>6.39</td>
<td>5.93</td>
<td>0.02*</td>
</tr>
<tr>
<td>FAMILIAR</td>
<td>1</td>
<td>4.41</td>
<td>4.09</td>
<td>0.05*</td>
</tr>
<tr>
<td>INTERNAL * FAMILIAR</td>
<td>1</td>
<td>3.31</td>
<td>3.07</td>
<td>0.08</td>
</tr>
<tr>
<td>Error</td>
<td>88</td>
<td>1.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R Squared = 0.13

Discussion of H1

The main effect of internalization reveals that it is beneficial to design an RA with high internalization. In other words, when a customer perceives that an RA can understand and
represent her real needs better, she will generate higher rational assessment for the RA’s competence, benevolence, and integrity. In addition, she will feel more secure and more comfortable about relying on the RA. However, it is still not clear about how to design and develop an RA with high internalization. This requires future study.

Discussion of H2

It is surprising to find that familiarity does not significantly affect cognitive trust, and that familiarity even decreases emotional trust. Based on the trust model proposed in section 2, and based on the partial analysis of the verbal protocols and written protocols that we collected during the experiment, our interpretation for the surprising result is as follows.

Table 4.4 Awareness of the known vs. Awareness of the unknown

<table>
<thead>
<tr>
<th></th>
<th>Customer</th>
<th>RA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness of the known:</td>
<td>I know that …</td>
<td>RA knows …</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RA does not know…</td>
</tr>
<tr>
<td>Awareness of the unknown:</td>
<td>I don’t know whether … or not</td>
<td>RA knows …</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RA does not know …</td>
</tr>
</tbody>
</table>

When the number of interactions between a customer and an RA increases, the familiarity increases (see the manipulation check in section 3). The increase of familiarity degree means the increase of both (a) the awareness of the known and (b) the awareness of the unknown (Table 4.4). The awareness of the known means what a customer knows for sure about the features and actions of an RA. Examples of the awareness of the known are: in our experiment, while she was shopping for a notebook computer with the help of an RA, subject 52 said, “Yes, [I trust the competence of the RA,] the list of comparison features is very complete and the information is correct (at least for the products I
know).” “Yes, they [the RA] only recommend products, they do not recommend buying, and they do not receive commission from manufacturers or retailers.” “[Do I feel comfortable about relying on the RA?] Very much, but I would seek recommendation on if I really need or not need some features from friends or professionals.” Another example, subject 51 thought aloud when the RA did not recommend anything based on her preferences, “Oh, no result! This is really annoying”. The examples show that customers build their cognitive trust on their awareness of the known; e.g. subject 52 built her cognitive trust in the RA’s competence based on her knowledge that “the list of comparison features is very complete, and the information is correct”. Customers also build their emotional trust on their awareness of the known; e.g. Subject 51 felt it “annoying” to rely on the RA, when she knew that the RA did not provide any recommendation.

The awareness of the unknown refers to the situations when a customer realizes her lack of knowledge about the features or actions of an RA. In other words, the customer is aware that she does not know whether an RA has a desirable feature or not. Example of the awareness of the unknown include: Subject 52 thought aloud, “Why doesn't the RA list Toshiba in its recommendation? I know this brand is very good. It should have comparable computers. Maybe it doesn’t have that specific. I don’t know how to say about that.” Subject 51 thought aloud, “It is still no result, OK, I don’t know what I should modify, maybe my hard drive is too big?” Another example, when an RA recommended quite a few products, subject 53 thought aloud, “So many
recommendations! How can I …? My goodness… *which to buy? I don’t know what’s wrong. Where to buy? Why it is not working?”

Figure 4.1: Familiarity affects cognitive trust and emotional trust

These examples show that the awareness of the unknown affects emotional trust more strongly than it affects cognitive trust. The awareness of the unknown will directly let a customer strongly feel insecure and uncomfortable about relying on the RA. However, we expect that a customer builds her cognitive trust mainly based on her awareness of the known rather than on her awareness of the unknown. The rationale may be that she will assign greater weight to her awareness of the known (e.g. “I know for sure that RA does/doesn’t knows…”) than the weight for her awareness of the unknown (“I guess that RA does/doesn’t knows …”).

According to our interpretation, when familiarity increases, the increased awareness of the known about the RA leads to an increase of both cognitive trust and emotional trust. However, the increased awareness of the unknown about the RA causes a larger decrease in emotional trust and a smaller decrease in cognitive trust. The decreased emotional trust caused by the awareness of the unknown is bigger than the increased emotional trust caused by the awareness of the known, because it is not easy to build trust, but it is easy
to destroy it. Therefore, familiarity decreases emotional trust in an RA. The decreased
cognitive trust caused by the awareness of the unknown is offset by the increased
cognitive trust caused by the awareness of the known; therefore, cognitive trust does not
drop significantly.

In addition, our experiment results do not agree with some of prior research in the context
of interpersonal trust. Prior research finds that familiarity builds interpersonal
relationship (Rempel, Holmes et al. 1985) and customer trust in a vendor in ecommerce
(Gefen 2000). Such a disagreement can be explained by the following three reasons.

(1) An RA is a computer agent instead of a human being. The RA’s that are currently
available in ecommerce now, including the one used in our empirical study,
cannot deal with a customer’s awareness of the unknown as flexibly as a person.
Therefore, the customer will continue worrying about the unknown and the
unresolved, which decreases both cognitive trust and emotional trust, especially
emotional trust. For example, during our experiment, when a customer was
wondering whether an RA knew about “battery life” (a feature for notebook), the
RA could not sense the customer’s awareness of the unknown, and then provided
the answer quickly. In fact, the RA did know “battery life”. In contrast, if a
customer is wondering about the same thing when she is shopping with a
salesperson, the salesperson will identify the customer’s awareness of the
unknown quickly, solve it immediately, and therefore increase both cognitive trust
and emotional trust. Such examples show the need to improve an RA’s adaptive
interactions with an online customer. This requires future research. Another
possible solution is to combine an RA with a human web-assistant working online when a customer needs help (Aberg and Shahmehri 2000).

(2) The interactions in ecommerce are not as rich as the interactions in traditional commerce. For example, when a customer was shopping for a notebook computer, she did not understand the differences between several types of screen technology, even after she read the RA’s explanations. However, in a physical store, a salesperson can show three notebook computers with three types of screen technology. Then the customer can understand exactly the quality differences, and decide on the quality which she prefers. This concern may be partially solved by embedding virtual reality technology inside an RA. This requires future study.

(3) The research methods are different. The two prior studies used surveys, while we used the experiment. In the experiment, the customers who were randomly assigned to the repeated-interaction groups finished all three interactions, even though some of them did not trust in the RA since the initial interaction. The two prior studies used a survey for the real online customers and real couples. When a subject did not trust an online vendor or her partner, she could have already stopped interacting with the vendor or the partner. Therefore, she would be included as one sample of unfamiliarity and low trust. Therefore, the research methods may also partially account for the disagreement of the research results.

4.2 H3: The impact of Trust in an RA on the Intentions to Adopt an RA

The intention to adopt an RA as a delegated agent
It is hypothesized that both cognitive trust (H3a) and emotional trust (H3b) will positively affect the intention to adopt an RA as a delegated agent. H3c hypothesizes that emotional trust will mediate the impact of cognitive trust on the intention to adopt an RA as a delegated agent.

As suggested by Baron and Kenny (1986), we used multiple regression analysis to test the mediating relationship.

Step 1: Show that cognitive trust significantly affects the intention to adopt an RA – Regression 1 by using the intention to adopt as the dependent variable, and using cognitive trust as the independent variable.

Step 2: Show that emotional trust significantly affects the intention to adopt an RA – Regression 2 by using the intention to adopt as the dependent variable, and using emotional trust as the independent variable.

Step 3: Show the relationship between cognitive trust and emotional trust – Regression 3 by using emotional trust as the dependent variable, and using cognitive trust as the independent variable.

Step 4: Show the mediating effect – Regression 4 by using the intention to adopt as the dependent variable, and using both cognitive trust and emotional trust as the independent variables. (1) If emotional trust is significant, and cognitive trust is not significant any more, then emotional trust fully mediates the impact of cognitive trust on the intention to adopt. (2) If emotional trust is significant, cognitive trust is still significant, but the coefficient of cognitive trust in Regression 4 is smaller than the coefficient of cognitive
trust in Regression 1, then emotional trust *partially mediates* the impact of cognitive trust on the intention to adopt an RA.

![Diagram](image)

**Figure 4.2 Results of testing H3a, H3b, and H3c**

The results of H3a, H3b, H3c tests are shown in Figure 4.2.

Step 1: Regression 1 shows that cognitive trust significantly affects the intention to adopt an RA as a delegated agent. In addition, since the impact of *cognitive trust* is positive and significant, H3a is supported. Regression 1 is:

\[
\text{Intention to adopt an RA as a delegated agent} = 0.37 + 0.62 \times \text{Cognitive Trust} \\
(F=27.60, p=0.00**, R^2=0.24; N=92)
\]

Step 2: Regression 2 shows that emotional trust significantly affects the intention to adopt an RA as a delegated agent. In addition, since the impact of *emotional trust* is positive and significant, H3b is supported. Regression 2 is:

\[
\text{Intention to adopt an RA as a delegated agent} = -0.07 + 0.76 \times \text{Emotional Trust} \\
(F=66.97, p=0.00**, R^2=0.43; N=92)
\]

Step 3: Regression 3 shows that cognitive trust significantly positively affects emotional trust. Regression 3 is:

\[
\text{Emotional Trust} = 0.42 + 0.84 \times \text{Cognitive Trust} \\
(F=129.64, p=0.00*, R^2=0.59; N=92)
\]
Step 4: Regression 4 shows that the impact of emotional trust is significant, while the impact of cognitive trust is not significant any more. Therefore, emotional trust fully mediates the impact of cognitive trust on the intention to adopt an RA as a delegated agent, which means H3c is supported. Regression 4 is:

\[
\text{Intention to adopt an RA as a delegated agent} = 0.03 - 0.05 \times \text{Cognitive Trust} + 0.80 \times \text{Emotional Trust}
\]

\[\text{(F}=33.21, \text{p}=0.00^*, \text{R}^2=0.43; \text{N}=92)\]

(The impact of Cognitive Trust is not significant: \(t=-0.34, \text{p}=0.74\))

(The impact of Emotional Trust is significant: \(t=5.47, \text{p}=0.00^{**}\))

In summary, H3a, H3b, H3c are all supported.

The intention to adopt an RA as a decision aid

It is hypothesized that both cognitive trust (H3d) and emotional trust (H3e) will positively affect the intention to adopt an RA as a decision aid. H3f hypothesizes that emotional trust will mediate the impact of cognitive trust on customer intention to adopt an RA as a decision aid.

![Figure 4.3 Results of testing H3d, H3e, and H3f](image)

The results of H3d, H3e, H3f tests are shown in Figure 4.3.

Step 1: Regression 1 shows that cognitive trust significantly affects the intention to adopt an RA as a decision aid. Since the impact of cognitive trust is positive and significant, H3d is also supported. Regression 1 is:
Intention to adopt an RA as a decision aid = 0.99 + 0.89 * Cognitive Trust  
(F=72.95, p=0.00**, R^2=0.45; N=92)

Step 2: Regression 2 shows that emotional trust significantly affects the intention to adopt an RA as a decision aid. Since the impact of *emotional trust* is positive and significant, H3e is also supported. Regression 2 is:

Intention to adopt an RA as a decision aid = 1.52 + 0.86 * Emotional Trust  
(F=90.44, p=0.00**, R^2=0.50; N=92)

Step 3: Regression 3 shows that cognitive trust significantly and positively affects emotional trust. Regression 3 is:

Emotional Trust = 0.42 + 0.84 * Cognitive Trust  
(F=129.64, p=0.00*, R^2=0.59; N=92)

Step 4: Regression 4 shows that the impact of emotional trust is significant, while the impact of cognitive trust is also significant, and the coefficient of cognitive trust in Regression 4 (0.41) is smaller than the coefficient in Regression 2 (0.89). Therefore, emotional trust *partially mediates* the impact of cognitive trust on the intention to adopt an RA as a decision aid, which means H3f is supported. Regression 4 is:

Intention to adopt an RA as a decision aid

\[ = 0.75 + 0.41 \times \text{Cognitive Trust} + 0.58 \times \text{Emotional Trust} \]

(F=52.13, p = 0.00*, R^2=0.54; N=92)  
(The impact of Cognitive Trust is significant: t = 2.72, p = 0.01**)  
(The impact of Emotional Trust is significant: t=4.21, p=0.00**) 

In summary, H3d, H3e, H3f are all supported.
Discussion of H3 tests

Prior research (Lewis and Weigert 1985) notes that cognitive trust and emotional trust will affect each other. It is interesting that our data supports the one directional relationship (from cognitive trust to emotional trust). Our interpretation is that cognitive trust may directly affect emotional trust, while it is possible that emotional trust will moderate the formation of cognitive trust instead of affect cognitive trust directly.

In addition, the experimental data shows that cognitive trust and emotional trust have significant impact on the intention to adopt an RA as a delegated agent ($R^2 = 0.43$) and on the intention to adopt an RA as a decision aid ($R^2 = 0.54$). The numbers also show that trust in an RA affects the intention to adopt an RA as a delegated agent less than it affects the intention to adopt an RA as a decision aid, or people are less likely to delegate to a computer agent than adopting it to help with decision making.

4.3 H4: The Two Intentions to Adopt an RA

H4 expects that the intention to adopt an RA as a delegated agent will be lower than the intention to adopt an RA as decision aid. The t-test ($t = 14.00$, $p = 0.00^{**}$, paired samples, 2 tailed) shows that H4 is supported.

Discussion of H4

The test result of H4 shows again that people are less likely to intend to delegate their purchase decision making to an RA than intend to adopt the RA as a decision aid. In addition, the correlation between the two adoption intentions is 0.39, which is significant,
but not very high. We think that one reason that the two adoption intentions are correlated is the shared cause – customer trust in an RA. However, the intention to adopt an RA as a delegated agent and the intention to adopt an RA as a decision aid are different at the conceptual level. As shown in Figure 4.4, there is no obvious linear relationship between them. The factor analysis of the measures also shows that the two adoption intentions are two different constructs.

Figure 4.4 Scatter Plot for the Two Adoption Intentions

5. Conclusions

Overall, the research model conceptualizes that both internalization and familiarity will positively affect cognitive trust and emotional trust in an RA, which then positively affects the intentions to adopt an RA as a delegated agent or as a decision aid. The substantial parts of the research model were supported. We found the surprising results about the impact of familiarity on customer trust, i.e. familiarity decreases emotional trust, and it does not significantly affect cognitive trust. We have provided our interpretations for the surprising results by explaining how a customer deals with both her awareness of the known and her awareness of the unknown when she forms her trust.
Theoretically, this study introduces one new construct – internalization. It also includes internalization as one antecedent for customer trust in computer agents. We propose that in agent-mediated electronic commerce, a customer will trust a customer agent and adopt it because “it represents me”. Our empirical study has provided evidence for the positive and significant impact of internationalization on both cognitive trust and emotional trust, and trust in an RA significantly and positively affects the intentions to adopt the RA. Future studies are needed on how to design and develop an RA with high internalization.

This study also contributes to our understanding of trust in agent-mediated ecommerce by proposing a new trust model which differentiates cognitive trust from emotional trust. The model conceptualizes how a customer will accept her rational interpretation of the known, and suspend worrying about the unknown, when she forms her trust. New measures of cognitive trust and emotional trust in an RA have been developed. We propose that emotional trust should be included in trust research, while prior research is predominantly concerned with cognitive trust and largely ignore emotional trust. The results also indicate a one directional relationship from cognitive trust to emotional trust. In addition, our empirical study shows that the same antecedent (e.g., familiarity) may have different impact on cognitive trust and emotional trust.

As far as we know, this study is the first to separate customer intention to adopt a computer agent into the intention to adopt a computer agent as a decision aid and the intention to adopt it as a delegated agent. We separate the two intentions because these
two intentions are qualitatively different. The intention to adopt a computer agent as a
delegated agent is essential in agent-mediated ecommerce. We have developed new
measures of the two adoption intentions. The factor analysis of the measurement shows
that these two intentions are two different constructs. We find that customer trust explains
the intention to adopt an RA as a decision aid ($R^2=0.54$) better than it explains the
intention to delegate to an RA ($R^2=0.43$). The intention to delegate to an RA is
significantly lower than the intention to adopt an RA as a decision aid. These results all
indicate that customers are less likely to delegate decision making to a computer agent
than adopting it as a decision aid.

Practically, our empirical study shows that internalization significantly increases both
cognitive trust and emotional trust in an RA, which significantly increases the intentions
to adopt an RA. Prior research has already provided evidences that using an RA improves
the efficiency and effectiveness of online shopping (Haubl and Trifts, 2000; Lynch and
Ariely, 2000). Therefore, our experiment result means that we should invest more efforts
to design and develop an RA with high internalization. The key of internalization is the
agent’s ability to understand and represent a customer’s real needs. If a customer is
unable to express her real needs into the appropriate product attributes, then a high-
internalization RA should be able to understand and represent a customer’s real needs by
helping a customer to convert her real needs into the appropriate product attributes or by
intelligently inferring a customer’s real needs.
Appendix:

Table 1: The measures for customer trust and intentions to adopt

<table>
<thead>
<tr>
<th>Source</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cognitive trust in an RA (including an RA’s competence, benevolence, and integrity)</strong></td>
<td></td>
</tr>
<tr>
<td>Plank, Reid et al. 1999</td>
<td>1. This RA is a real expert in assessing products.</td>
</tr>
<tr>
<td>Hawes, Mask et al. 1989</td>
<td>2. This RA is competent in evaluating available product choices. (*)</td>
</tr>
<tr>
<td>New</td>
<td>3. This RA has the expertise to understand my needs and preferences about products.</td>
</tr>
<tr>
<td>New</td>
<td>4. This RA has the ability to capture my needs and preferences about products.</td>
</tr>
<tr>
<td>Hawes, Rao et al. 1993</td>
<td>5. This RA has good knowledge about products</td>
</tr>
<tr>
<td>New</td>
<td>6. This RA considers all important factors about products and my needs before it provides me with product recommendation.</td>
</tr>
<tr>
<td>Plank et al. 1999</td>
<td>18. The recommended product has all technical attributes necessary to do its job.</td>
</tr>
<tr>
<td>New</td>
<td>19. I can rely on the technical quality of the recommended product. (*)</td>
</tr>
<tr>
<td>Hawes, Mast, and Swan, 1989</td>
<td>20. The recommended product is dependable. (*)</td>
</tr>
<tr>
<td>New</td>
<td>21. The recommended product fits my needs. (*)</td>
</tr>
<tr>
<td>Swan, Trawick et al. 1988; Crosby, Evans et al. 1990</td>
<td>7. This RA puts my interest first.</td>
</tr>
<tr>
<td>Doney and Cannon 1997</td>
<td>8. This RA is concerned with my needs and preferences.</td>
</tr>
<tr>
<td>New</td>
<td>9. This RA wants to understand my needs and preferences.</td>
</tr>
<tr>
<td>New</td>
<td>10. This RA provides unbiased product recommendations.</td>
</tr>
<tr>
<td>Hawes et al. 1989</td>
<td>11. This RA is honest.</td>
</tr>
<tr>
<td>New</td>
<td>12. I consider this RA to be of integrity.</td>
</tr>
</tbody>
</table>

**Emotional Trust in an RA**
13. I feel secure about relying on this RA for my decision.
14. I feel comfortable about relying on this RA for my decision.
15. I feel happy about relying on this RA for my decision.
16. I feel confident about relying on this RA for my decision.
17. I feel content about relying on this RA for my decision.
22. I feel secure about relying on the recommended product for my decision.
23. I feel comfortable about relying on the recommended product for my decision.
24. I feel happy about relying on the recommended product for my decision.
25. I feel confident about relying on the recommended product for my decision.
26. I feel content about relying on the recommended product for my decision.

**Intention to adopt an RA as a delegated agent**

27. I am willing to delegate to this RA for my decision about which product to buy.
28. I am willing to let this RA decide which product to buy on my behalf.
29. I will be satisfied to let this RA choose the best product for me.

**Intention to adopt an RA as a decision aid**

30. I am willing to use this RA as an aid to help with my decision about which product to buy.
31. I am willing to let this RA assist me decide which product to buy.
32. I am willing to use this RA as a tool that suggests to me a number of products from which I can choose.

Note 1: The items with * (i.e. items 2, 19, 20, 21) were deleted based on the results of factor analysis.
Note 2: All the four scales above are 7-point Likert-type questions anchored with strongly agree and strongly disagree.

**Table 2: Measures for controlled variables**

<table>
<thead>
<tr>
<th>Control propensity (new)</th>
<th>33. I need to have full control of RA before I fully trust it.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>34. I am not willing to rely on a RA if I cannot fully control it.</td>
</tr>
<tr>
<td></td>
<td>35. Full control of a RA is necessary for me to feel comfortable with its advice.</td>
</tr>
<tr>
<td>Trust propensity (Lee and Turban 2001)</td>
<td>36. It is easy for me to trust a person/thing.</td>
</tr>
<tr>
<td></td>
<td>37. My tendency to trust a person/thing is high.</td>
</tr>
<tr>
<td></td>
<td>38. I tend to trust a person/thing, even though I have little knowledge of it.</td>
</tr>
<tr>
<td></td>
<td>39. Trusting someone or something is not difficult.</td>
</tr>
</tbody>
</table>
40. I am willing to examine the product attributes very carefully in order to make sure that the product fits my preferences perfectly.

41. I prefer to shop hard in order to get exactly what I want.

42. My time is valuable. As soon as I find a product that is adequate for my needs, I will buy it. (Note: This scale is reversed.)

Note: Product expertise will be tested by a combination of self-reporting and objective tests (source of the questions and answers: www.activebuyerguide.com).

Table 3: Results of the third cards-sorting (all 42 items in table 1 and table 2)

<table>
<thead>
<tr>
<th></th>
<th>Placement Ratio (card sorting)</th>
<th>Correlation</th>
<th>Cronbach Alpha</th>
<th>Cohen’s Kappa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>0.93</td>
<td>0.93</td>
<td>0.99</td>
<td>0.89</td>
</tr>
</tbody>
</table>

Table 4: Results of Factor Analysis (28 items in table 1. Valid sample size=162)

Eigenvalues

<table>
<thead>
<tr>
<th>Factor</th>
<th>Initial Eigenvalue</th>
<th>Total % of Variance</th>
<th>Cumulative %</th>
<th>Extraction Sums of Squared Loading Total</th>
<th>% of Variance</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12.48</td>
<td>44.59</td>
<td>44.59</td>
<td>12.12</td>
<td>43.30</td>
<td>43.30</td>
</tr>
<tr>
<td>2</td>
<td>1.99</td>
<td>7.10</td>
<td>51.70</td>
<td>1.59</td>
<td>5.69</td>
<td>48.99</td>
</tr>
<tr>
<td>3</td>
<td>1.78</td>
<td>6.38</td>
<td>58.08</td>
<td>1.40</td>
<td>5.00</td>
<td>53.98</td>
</tr>
<tr>
<td>4</td>
<td>1.52</td>
<td>5.42</td>
<td>63.51</td>
<td>1.13</td>
<td>4.05</td>
<td>58.03</td>
</tr>
<tr>
<td>5</td>
<td>1.19</td>
<td>4.26</td>
<td>67.78</td>
<td>0.89</td>
<td>2.93</td>
<td>60.95</td>
</tr>
<tr>
<td>6</td>
<td>0.85</td>
<td>3.05</td>
<td>70.83</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Extraction Method: Principal Axis Factoring.

Pattern Matrix

<table>
<thead>
<tr>
<th>Factor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.372</td>
<td>-.470</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>.832</td>
<td>-.559</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>.559</td>
<td>-.506</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>.686</td>
<td>-.422</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>.618</td>
<td>-.506</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>.703</td>
<td>-.422</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>.600</td>
<td>-.506</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>.600</td>
<td>-.422</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>.832</td>
<td>-.559</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>.832</td>
<td>-.559</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Extraction Method: Principal Axis Factoring.
Rotation Method: Oblimin with Kaiser Normalization.
The loadings converged in 16 iterations.
The loadings that are less than 0.30 have been removed.

Table 5: Results of reliability tests

<table>
<thead>
<tr>
<th></th>
<th>Cognitive trust in the competence of RA</th>
<th>Cognitive trust in the benevolence of RA</th>
<th>Cognitive trust in the integrity of RA</th>
<th>Emotional trust in an RA</th>
<th>Intention to adopt an RA as a delegated agent</th>
<th>Intention to adopt an RA as a decision aid</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>0.85</td>
<td>0.74</td>
<td>0.70</td>
<td>0.95</td>
<td>0.71</td>
<td>0.91</td>
<td>0.81</td>
</tr>
<tr>
<td>Note: valid sample size</td>
<td>161</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Results of reliability tests (main experiment)

<table>
<thead>
<tr>
<th></th>
<th>Cognitive trust in the competence of RA</th>
<th>Cognitive trust in the benevolence of RA</th>
<th>Cognitive trust in the integrity of RA</th>
<th>Emotional trust in an RA</th>
<th>Intention to adopt an RA as a delegated agent</th>
<th>Intention to adopt an RA as a decision aid</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>0.84</td>
<td>0.83</td>
<td>0.86</td>
<td>0.95</td>
<td>0.76</td>
<td>0.87</td>
<td>0.85</td>
</tr>
<tr>
<td>Note: valid sample size</td>
<td>92</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Results of reliability tests (main experiment)

<table>
<thead>
<tr>
<th></th>
<th>Control propensity</th>
<th>Trust propensity</th>
<th>Preference for effort saving vs. decision quality</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>0.87</td>
<td>0.84</td>
<td>0.78</td>
<td>0.83</td>
</tr>
<tr>
<td>Note: valid sample size</td>
<td>92</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
References:


