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Reducing Perceived Deceptiveness of E-Commerce Product Recommendation Agents: An Empirical Examination of the Relative Impact of Transparency and Verifiability and the Moderating Role of Gender

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ABSTRACT

Product Recommendations Agents (PRAs) are software applications that augment consumers' purchasing decisions by offering product recommendations based on consumers' preferences that are elicited either explicitly or implicitly. The underlying premise of PRAs is often grounded on the assumption that PRAs seek to optimize consumers' utility with the recommendations provided. However, since a majority of commercial PRAs are implemented by parties with vested interests in product sales, it is highly probable that recommendations are biased in favor of their providers and do not reflect consumers' interests. This in turn may possibly induce a deceptiveness perception among consumers. As such, this study theorizes and empirically demonstrates that the induction of IT-mediated components in PRAs, which induce high levels of perceived transparency and perceived verifiability, could be useful in mitigating consumers' perceived deceptiveness of PRAs. This study also explores the moderating role of gender in the relationship between transparency/verifiability perception and deceptiveness perception.

Keywords

Product Recommendation Agents, Electronic Commerce, Deception, Transparency, Verifiability, Gender

INTRODUCTION

Digital marketplaces offer consumers great convenience, immense product choice, and large amount of product-related information. However, as a result of the cognitive constraints of human information processing, finding products that satisfy customers' needs and/or interests is not an easy task. Therefore, many online stores have made available web-based decision support systems in the form of Product Recommendation Agents (PRAs) to assist consumers in product search and selection. PRAs are software applications that elicit the interests or preferences of individual customers for products, either explicitly or implicitly, and make recommendations accordingly (Xiao & Benbasat, 2007). By providing product recommendations based on expressed consumer interests, preferences, or needs, a consumer's shopping history or web navigation pattern, and/or choices made by other consumers with similar profiles, PRAs have the potential to reduce consumers' information overload and search complexity, while at the same time improving their decision quality (Haubl & Trifts, 2000; Maes, 1994).

However, the degree to which PRAs actually empower consumers depends upon the veracity and objectivity of the PRAs (Hill, King, & Cohen, 1996; King & Hill, 1994). Prior research has demonstrated that PRAs have the potential to not only assist consumers but also steer them in a particular direction, which makes them "double agents" (Haubl & Murray, 2006). Consumers who are sensitized to the double role played by online PRAs, via news stories or warnings issued by consumer organizations, may become hesitant to use the assistance of PRAs when making purchases online, for fear of being exploited by unscrupulous PRA providers (e.g., dishonest online retailers). Such general reluctance not only deprives consumers of the potential benefits offered by PRAs but also makes a mockery of the effort exerted by honest online retailers in implementing PRAs on their websites.

Few empirical studies (e.g., Aksoy & Bloom, 2001; Cosley, Lam, Albert, Konstan, & Riedl, 2003; Haubl & Murray, 2003; Xiao & Benbasat, 2010) have looked into the phenomenon of PRA deception. Among them, none has examined factors that can help mitigate consumers' perception of PRA deceptiveness once their suspicion has been aroused. This study fills this gap in literature by investigating the relative impact of two consumer perceptions (i.e., transparency and verifiability, induced by design mechanisms of a PRA) on reducing consumers' perception of the PRA's deceptiveness and exploring the role of gender in moderating such relationships.

Perceived PRA deceptiveness is defined in this study as consumers' belief, held without sufficient evidence to warrant certainty, that the PRA is being deceptive (Buller & Burgoon, 1996). It is often triggered by negative-valenced violation of preconceived expectations or the recognition of situational cues suggesting deception. News stories or warning messages that alert consumers to potential deception by PRAs can also trigger deceptiveness perception. *Perceived deceptiveness* falls along a truth-falsity judgment continuum (Buller & Burgoon, 1996). Since a customer whose perception of deception has been triggered usually exists in a state of uncertainty as to the honesty of the PRA, she is likely to solicit extra evidence or proof in order to arrive at a firm conviction about the PRA's truthfulness. We argue that the *transparency* of the PRA and the *verifiability* of a PRA's recommendations present the needed evidence for the consumer to defray her perception of deception towards the PRA's recommendations.

The remainder of this paper is organized as follows. Section 2 presents the research model and develops hypotheses. The research method and results of hypothesis testing are reported in section 4 and 5, and the paper concludes with a discussion of the results, limitations, and contributions of the study and some future research areas.

THEORETICAL FOUNDATION

In this section, we introduce the theoretical foundation for this study and present the research model and related hypotheses.

Perceived Transparency

Transparency of a system (i.e., openness the system toward its users) is critical in gaining users' trust in the system (Lewicki, Mcallister, & Bies, 1998). For instance, Nickerson (1999) and Hertzum et al. (2002) showed that the transparency of interactive systems facilitated users' conceptualization of the systems, and thus increased their trust in the systems. A PRA is considered transparent when consumers can easily comprehend the reasoning process with which the PRA generates its product recommendations (Wang, 2005). A transparent PRA can relieve consumers of their worries about potential deceptive manipulations that can be designed into the PRA and increase consumers' confidence in the veracity and objectivity of the PRA. For instance, Sinha and Swearingen (2002) as well as Wang (2005) demonstrated that users' perception of PRA transparency enhanced their trust and confidence in the PRA's recommendations. Thus,

H1: *Perceived PRA transparency* reduces consumers' *perception* of the *deceptiveness* of the PRA.

Prior PRA research has highlighted the role of explanations in influencing consumers' attitude toward a PRA's recommendations. For instance, Herlocker, Konstan, and Riedl (2000) note that the lack of transparency of most collaborative-filtering systems has prevented the widespread acceptance of such systems. Wang and Benbasat (Wang, 2005; Wang & Benbasat, 2005) observed that content-filtering PRAs providing three types of explanations (i.e. how explanations, why explanations, and guidance) were deemed more transparent and consequently more trustworthy by consumers on consumers' trusting beliefs in content-filtering PRAs. Despite the *trust* focus in these studies, the same reasoning is amenable to our research context. For instance, when a consumer's perception of deceptiveness is triggered by unexpected PRA recommendations (e.g., when a PRA suggests an unusual product) or warnings from third parties, explanations concerning how the consumer's preferences and requirements (expressed explicitly or implicitly) are translated to criteria for generating recommendations should enhance consumers' perception of the transparency of the PRA. Thus,

H2: The provision of *explanation facilities* enhances consumers' *perception* of *PRA transparency*.

Perceived Verifiability

Verifiability refers to the possibility of determining or testing the truth or accuracy of something by comparison, investigation, or reference (Dictionary.com). Research in communication has established a positive relationship between the *verifiability* of a message and the likelihood of individuals relying on such information when making decisions (Calfee & Ford, 1988). In online context, when consumers' perception of PRA deceptiveness has been triggered, the ease for them to

verify a PRA's recommendations is likely to move their perception towards the "truth" end of the truth-falsity judgment continuum. Therefore, the *perceived verifiability* of a PRA's recommendations (i.e., the extent to which consumers perceive that the appropriateness of a PRA's product recommendations can be determined) will diminish perceptions of deceptiveness towards the PRA. Thus,

H3: *Perceived verifiability* of a PRA's recommendations reduces consumers' *perception* of the *deceptiveness* of the PRA.

Prior PRA research (Komiak, Wang, & Benbasat, 2005; Wang, 2005; Wang & Benbasat, 2004) has revealed that, when consumers held some suspicion regarding the truthfulness of a PRA, the absence of effective means to verify the PRA's recommendations resulted in trust deterioration. A simple means for consumers to corroborate a PRA's recommendations consists of comparing the recommendations against certain criteria: They can either compare features of recommended products with their expressed preferences on those attributes or compare recommended products with one another. A PRA that provides mechanisms (e.g., search and compare functionality) for consumers to ascertain the appropriateness of its recommendations will likely enhance consumers' perception of the verifiability of the PRA and ease their suspicion. Thus,

H4: The provision of *verification mechanism* enhances consumers' *perception* of the *verifiability* of the PRA.

Rosenthal (1971) notes that a message is considered verifiable if it can be confirmed empirically by means independent of its source and available to the audience. Churchman (1971) further argues that a system cannot serve as its own guarantor. A system's self-reflections (e.g., explanations provided by the system) are not powerful enough to prove the validity of the information it produces (e.g., recommendations). We thus postulate that, compared to *perceived transparency* (induced by internal, system-generated explanations), *perceived verifiability* (enhanced by verification mechanisms provided for consumer use) will provide stronger evidence for consumers to arrive at a conviction about the PRA's truthfulness

H5: Compared to *perceived PRA transparency*, *perceived verifiability* of a PRA's recommendations exerts greater impact in reducing consumers' *perception* of the *deceptiveness* of the PRA.

The Role of Gender

Prior research has demonstrated significant gender differences across a variety of decision making tasks, such as financial decision making (Powell & Ansic, 1997), hospital problem solving (Steffen & Nystrom, 1988), and technology adoption, continuance, and switching (e.g., Shi, et al., 2009; Venkatesh, Morris, & Ackerman, 2000; Zhang, Lee, Cheung, & Chen, 2009). Nevertheless, there have been a limited number of studies examining gender differences in online trust/distrust and related behaviors (Riedl, Hubert, & Kenning, 2010). The current study contributes to research in this area by exploring the potential role of gender in moderating the effect of perceived transparency/verifiability in reducing consumers' perception of PRA deceptiveness.

Research in experimental economics has concluded that women are generally less trusting than men, demonstrated by the reluctance of women to send more money to opponents in economic games (e.g., Buchan, Croson, & Solnick, 2008; Snijders & Keren, 1999). A number survey studies in economics have also provided support for such findings (e.g., Alesina & La Ferrara, 2002; Glaeser, Laibson, Scheinkman, Scheinkman, & Soutter, 2000), which can be explained by the different social roles played by women vs. men in the society. Women, who traditionally perform the role of nurturers and care providers, are more concerned about risks in the environment (Davidson & Freudenburg, 1996) and less willing to render themselves (and their loved ones) vulnerable to potential harm from scrupulous others. In e-commerce context, women have been found to rate the trustworthiness of web shopping lower (Van Slyke, C., & Belanger, 2002), hold less positive attitudes toward web advertising (Wolin & Korgaonkar, 2003), and perceive higher level of risk in online purchasing (Garbarino & Strahilevitz, 2004; Sheehan, 1999).

Past research has also revealed important differences between males and females in information processing. While men are found to be "selective processors" who often do not engage in comprehensive information processing before making judgment, women are considered "comprehensive processors" who usually attempt effortful elaboration of all available information (Meyers-Levy & Sternthal, 1991). In the context of this study, the willingness of women to engage in effortful and comprehensive information processing (e.g., using search and compare functionality to corroborate a PRA's recommendations), coupled with their inclination to withhold trust and be self-guarded when faced with uncertainty, may render them more likely to place great importance on *verifiability* perception (engendered by the verification mechanisms that they can utilize to corroborate the PRA's recommendations), as opposed to *transparency* perception (induced by system-provided explanations), in making judgment about the deceptiveness of the PRA. In contrast, as "selective processors" who tend to make quick decisions without processing information exhaustively, men may be equally likely to rely on perceptions

of transparency and verifiability as diagnostic cues in judging the truthfulness of the PRA. As a result, while perceived verifiability will be of greater significance to women (than to men) in mitigating their perception of PRA deceptiveness, perceived transparency will be more important to men (than to women).

H6a: *Perceived verifiability* of a PRA's recommendations exerts greater impact on reducing the *perception* of PRA *deceptiveness* for *female* consumers than for *male* consumers.

H6b: *Perceived PRA transparency* exerts greater impact on reducing the *perception* of PRA *deceptiveness* for *male* consumers than for *female* consumers.

The research model for this study is presented in Figure 1.

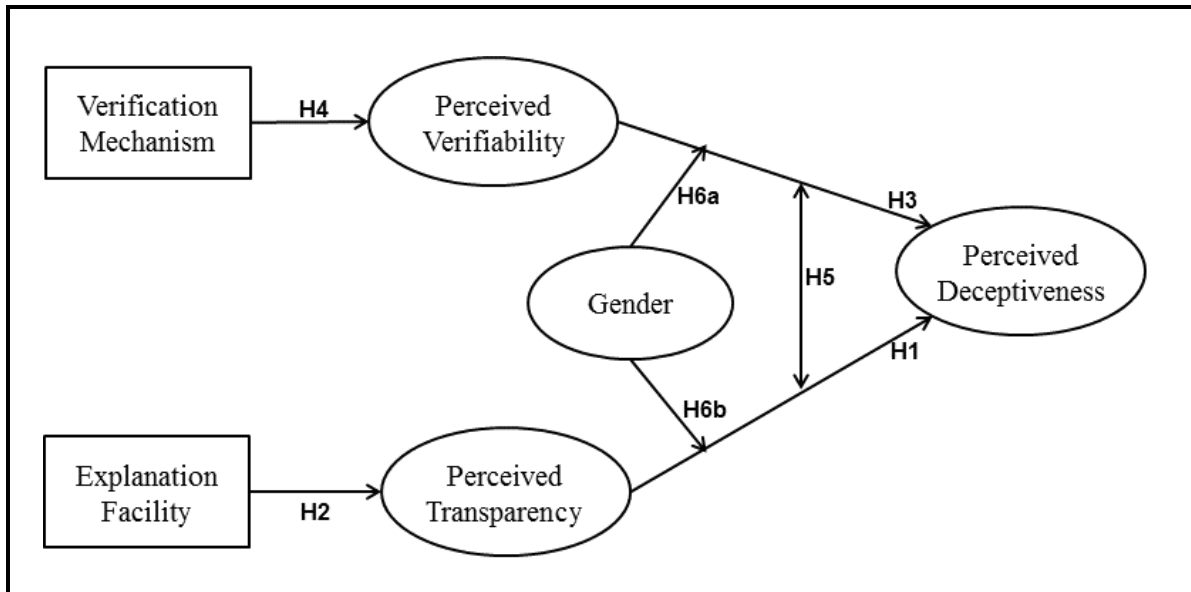


Figure 1 Research Model

RESEARCH METHOD

A laboratory experiment employing 2 (*Explanation Facility*: With vs. Without) x 2 (*Verification Mechanism*: With vs. Without) between-subject factorial design was conducted to test the hypothesized effects.

Experimental Design

Four experimental websites were developed for this study, with each website featuring the same 96 digital cameras from 8 brands. Since each website had a PRA available to help consumers search and evaluate products, four needs-based content-filtering PRAs for digital cameras were adapted from Xiao (2010). The four PRAs were comparable in all aspects except for the experimental manipulations.

Explanation facility was manipulated by the absence or presence of explanations (see Appendix 1 for illustration), whereas *verification mechanism* was manipulated by the absence or presence of the functionalities that allow users to search products by brand and to compare recommended products with one another (see Appendix 1 for illustration).

Measurement of Dependent Variables

The measurement items for *perceived verifiability* were newly developed for this study, following standard psychometric scale development and validation procedures (Moore & Benbasat, 1991). *Perceived transparency* and *perceived deceptiveness* were measured via 7-point scales adapted from prior research (Wang, 2005; Xiao & Benbasat, 2010) and validated via several rounds of pilot testing.

Sample

A total of 217 students from a public university in Hong Kong participated in the experiment. Each participant received HK \$50 (approximately 6.5 USD) for participation plus 1-in-3 chance of getting additional HK \$50 performance-based incentive.

Experimental Task and Procedures

Upon arriving at the lab, all participants were randomly assigned to one of the four experimental groups. They were told that a limited selection of digital cameras was currently on sale at an online camera store. They were asked to visit the online camera store, explore the alternatives, and choose a digital camera as gift for a close friend with the assistance of a Shopping Advisor (i.e., the PRA) available at the website. They were also informed that, at the end of the task session, they would be asked to provide an evaluation of the e-commerce website, and that time was not limited.

Participants were first asked to complete a short questionnaire to collect demographic data (e.g., age, gender) and background information. After watching a tutorial video on how to navigate their assigned e-commerce website, participants were asked to read task instructions and then click on a “Start Shopping” button that would take them to their assigned e-commerce website. To trigger participants’ *perception of PRA deceptiveness*, a warning message (about potential deceptive manipulations that can be designed into PRAs to mislead consumers) was displayed when they clicked on the “Start Shopping” button. Participants then proceeded with the shopping task at their assigned e-commerce website. Upon the completion of the shopping task, participants were asked to fill out a questionnaire that included the measures of the dependent variables.

DATA ANALYSIS AND RESULTS

Partial Least Squares (PLS), as implemented in SmartPLS 2.0.M3, was used to assess both the measurement model and the structural model.

Controls and Manipulation Checks

No significant differences were found among participants in terms of individual characteristics (such as age, gender, Internet usage, and online shopping experience). Manipulation checks (see Appendix 2) revealed that (1) both the *explanation facility* and the *verification mechanism* were implemented successfully, and (2) participants’ perception of uncertainties associated with the use of PRAs (measured after the showing of the warning message and immediately prior to the start of the shopping task) was significantly greater than neutral (i.e., the value “4” on a 7-point scale from) (Mean = 4.5, $t(216) = 8.459$, $p < 0.001$), suggesting that the warning message was successful in sensitizing participants to the potential deception by PRAs.

Measurement Model

All the variables (except the two manipulated variables) were modeled as reflective constructs. Individual item reliability, internal consistency, and discriminant validity were examined following guidelines for testing measurement models in PLS suggested by Barclay et al. (1995) and Gefen and Straub (2005). Individual item reliability was examined by the loadings of measures with their corresponding construct (see Table 1). All the loadings exceed 0.7, indicating good item reliability.

	Deceptiveness	Transparency	Verifiability
Deceptiveness1	0.89	-0.46	-0.55
Deceptiveness2	0.88	-0.46	-0.53
Deceptiveness3	0.86	-0.50	-0.48
Transparency1	-0.42	0.74	0.41
Transparency2	-0.49	0.86	0.52
Transparency3	-0.43	0.74	0.37
Transparency4	-0.41	0.83	0.46
Transparency5	-0.38	0.83	0.39
Transparency6	-0.41	0.84	0.46
Transparency7	-0.42	0.82	0.42

Verifiability1	-0.51	0.48	0.84
Verifiability2	-0.57	0.50	0.88
Verifiability3	-0.51	0.44	0.86
Verifiability4	-0.49	0.43	0.87

Table 1. Loadings and Cross loadings

Internal consistency was assessed by examining both composite reliability and Cronbach's alpha, which are reported in Table 2. The benchmark for acceptable reliability is 0.7. All constructs met this criterion, indication that the measures have good internal consistency.

	Cronbach's Alpha	Internal Consistency	1	2	3
1. Transparency	0.91	0.93	0.81		
2. Verifiability	0.88	0.92	0.54	0.86	
3. Deceptiveness	0.91	0.93	-0.53	-0.60	0.85

Note: The scores in the diagonal of the matrix are square roots of AVEs while the lower triangle represents the correlations between constructs

Table 2. Internal Consistencies, AVEs, and Correlations of Constructs

Barclay et al. (1995) suggest two criteria for discriminant validity. First, the square root of AVE of a construct should be greater than the correlations of the construct with other constructs. This criterion is satisfied by all the data, as demonstrated in Table 2. Second, no item should load higher on a construct other than the one it intends to measure. An examination of the loadings and cross-loadings of measures in Table 1 reveals that all items satisfy this criterion.

Results of Hypothesis Tests

Results of two separate ANOVA tests reveal that participants provided with explanation facilities (verification mechanisms) have significantly higher perception of transparency (verifiability) than those not provided with such facilities (mechanisms) (3.51 vs. 4.19, $F(215) = 16.837, p < 0.001$ for transparency; 4.25 vs. 4.65, $F(215) = 5.899, p < 0.001$ for verifiability), thus supporting **H2** and **H4**.

Figure 2 shows the results of the PLS analyses performed on the whole sample ($N = 217$), the female sample ($N = 112$), and the male sample ($N = 105$). As illustrated in Figure 2a (i.e., PLS analysis on the whole sample), both *perceived transparency* and *perceived verifiability* exert significant negative impact on *perceived deceptiveness* ($\beta = -0.283, p < 0.001$; $\beta = -0.452, p < 0.001$), thus supporting **H1** and **H3**. A comparison of the two path coefficients (i.e., path coefficient between *transparency* and *deceptiveness* vs. path coefficient between *verifiability* and *deceptiveness*) was first performed on the whole sample via the formula below:

$$t = \frac{PC1 - PC2}{\sqrt{se1^2 + se2^2}}$$

where PC_i = path coefficient in structural model under comparison, se_i = standard error of path coefficient PC_i and t = t -statistic with $n - 1$ degrees of freedom. Result of the computation reveals that the path coefficient between *verifiability* and *deceptiveness* is significantly larger than that between *transparency* and *deceptiveness* ($t(216) = 2.83, p < 0.01$), suggesting that *perceived verifiability* is more important than *perceived transparency* in reducing consumers' perception of PRA deceptiveness. **H5** is thus supported.

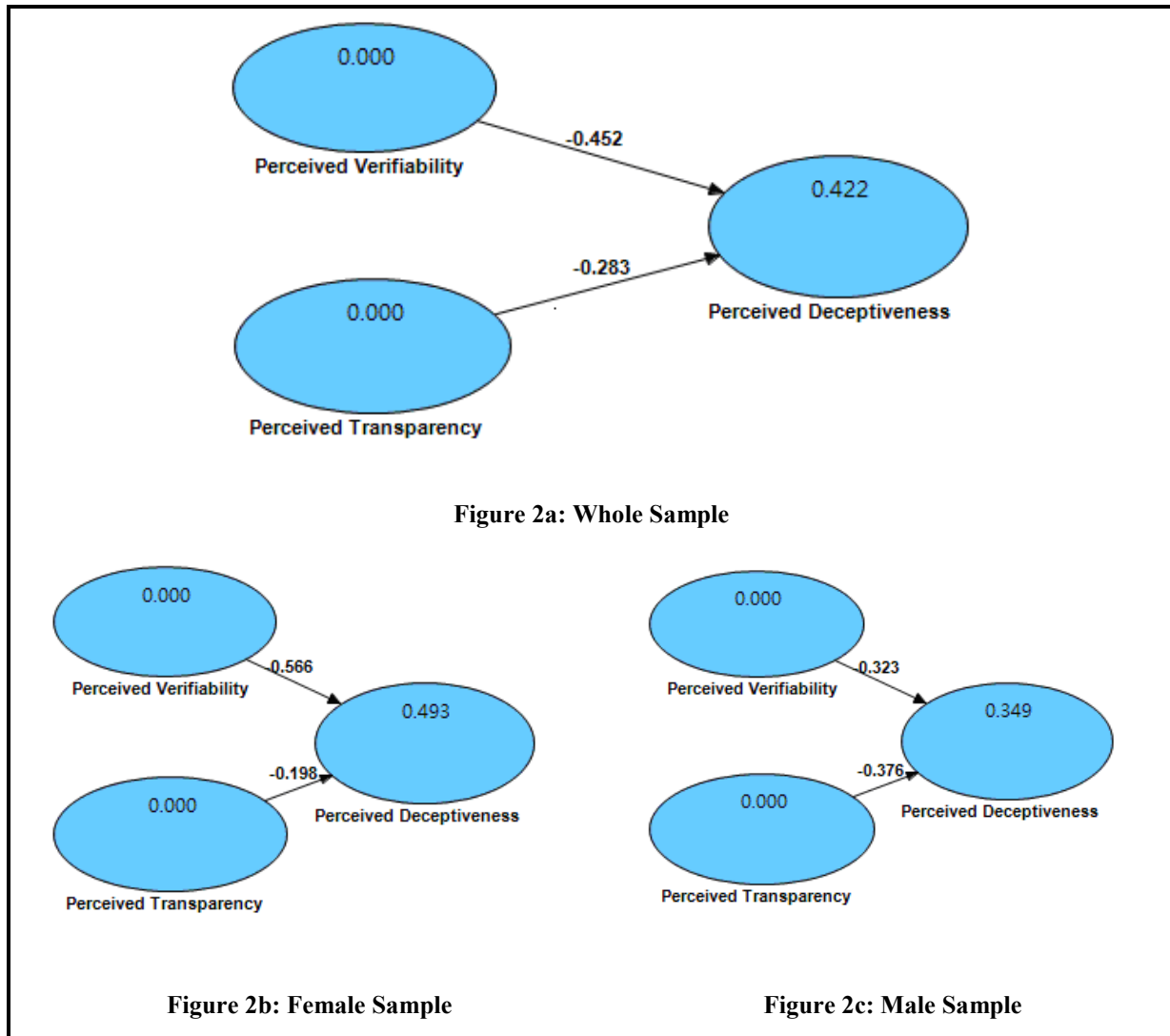


Figure 2. Results of PLS Analysis

The coefficient of the path from perceived *verifiability* (*transparency*) to perceived *deceptiveness* in the female sample (Figure 2b) was then compared to that of the male sample (Figure 2c). As hypothesized, while the path coefficient between *verifiability* and *deceptiveness* is significantly larger for *females* than for *males* ($t(216) = 3.806, p < 0.001$), the coefficient of the path joining *transparency* and *deceptiveness* is significantly larger for *males* than for *females* ($t(216) = 3.653, p < 0.001$), thus providing support for both **H6a** and **H6b**.

CONCLUSION AND DISCUSSION

This experimental study provides strong evidence that in situations where consumers are alerted to potential deception by online PRAs, properly designed explanation facilities and verification mechanisms are effective in inducing consumers' perceptions of *transparency* and *verifiability*, which in turn reduce consumers' perception of PRA *deceptiveness*. In addition, while *verifiability* (when compared to *transparency*) is a significantly more important consideration for females to mitigate their perception of PRA *deceptiveness*, both perceived *transparency* and perceived *verifiability* are central for reducing the *deceptiveness* perception of males.

The study makes significant contribution both to research and to practice. First, despite considerable research over the years into both PRAs and deception, an intersection of these two research streams is still lacking. Making a timely attempt to

investigate deceptive PRAs, this paper represents a pertinent contribution to theory building in both PRA and deception research. Second, an examination of the effect of gender in moderating the relationship between transparency/verifiability and perception of deceptiveness, this study enriches our understanding of gender differences in online trust/distrust and related behaviors. Third, by investigating IT artifacts that can mitigate consumers' negative perceptions of PRAs and their recommendations, this study provides valuable input to e-commerce practitioners in their effort to ease the uncertainties of consumers shopping at e-commerce websites and contributes to the sustained viability of agent-mediated e-commerce. Finally, the results of the study suggest that, when resources are limited, verification mechanisms (inducing perception of verifiability) should be given priority over explanation facilities (inducing perception of transparency), particularly if the websites where the PRAs are embedded target female customers.

Notwithstanding its contributions, this study has a number of limitations. First, the study only examines two verification mechanisms (i.e., search by brand and cross-comparison functionalities). Future research is needed to investigate other IT artifacts that have the potential to enhance consumers' perception of the verifiability of PRAs. Second, this study implements needs-based content-filtering PRAs in recommendation products. Future studies should explore other types of PRAs, as different types of PRAs may generate different levels of transparency and verifiability perceptions. For instance, although both content-filtering and collaborative-filtering PRAs can enhance transparency via providing explanations, they manifest differential verifiability. Whereas the attribute-based nature of content-filtering PRAs makes it easy for consumers to compare features of recommended products with their expressed preferences for product features, recommendations generated by collaborative-filtering PRAs, which are based on user-to-user similarity, are more difficult to verify by such means. In addition, PRAs that provide recommendations proactively will be more likely to be perceived as deceptive by consumers, due to their tendency to recommend novel products or their aggressiveness in recommending. As such, the PRA mechanisms that warrant consumers to use perceived transparency and perceived verifiability to defray perception of deceptiveness may be stronger for these types of PRAs than for PRAs that provide recommendation reactively.

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REFERENCES

1. Aksoy, L., & Bloom, P. N. (2001, February 15-17). *Impact of Ordered Alternative Lists on Decision quality: The Role of Perceived Similarity*. Paper presented at the The Society for Consumer Research Winter Conference, Scottsdale, AZ.
2. Alesina, A., & La Ferrara, E. (2002). Who Trusts Others? *Journal of Public Economic* 85(2), 207-234.
3. Barclay, D., Higgins, C., & Thompson, R. (1995). The partial least squares (PLS) approach to causal modeling: Personal computer adoption and use as an illustration. *Technology studies*, 2(2), 285-309.
4. Buchan, N. R., Croson, R. T. A., & Solnick, S. (2008). Trust and Gender: An Examination of Behavior and Beliefs in the Investment Game. *Journal of Economic Behavior & Organization*, 68(3-4), 466-476.
5. Buller, D. B., & Burgoon, J. K. (1996). Interpersonal deception theory. *Communication Theory*, 6(3), 203-242.
6. Calfee, J., & Ford, G. T. (1988). Economics, information and consumer behavior. *Advances in Consumer Research*, 15, 234-238.
7. Churchman, C. W. (1971). *The Design of Inquiring Systems: Basic Concepts of Systems and Organization*: Basic Books Inc.
8. Cosley, D., Lam, S. K., Albert, I., Konstan, J., & Riedl, J. (2003, April 5-10). *Is Seeing Believing? How Recommender Systems Influence Users' Opinions*. Paper presented at the Proceedings of the SIGCHI conference on Human factors in computing systems, Fort Lauderdale, FL.
9. Davidson, D. J., & Freudenburg, W. R. (1996). Gender and environmental concerns: A review and analysis of available research. *Environmental Behavior*, 28, 302-339.
10. Garbarino, E., & Strahilevitz, M. (2004). Gender Differences in the Perceived Risk of Buying Online and the Effects of Receiving a Site Recommendation. *Journal of Business Research*, 57(7), 768-775.
11. Gefen, D., & Straub, D. (2005). A practical guide to factorial validity using PLS-Graph: Tutorial and annotated example. *Communications of the Association for Information systems*, 16, 91-109.
12. Glaeser, E. L., Laibson, D. I., Scheinkman, J. A., Scheinkman, J. A., & Soutter, C. L. (2000). Measuring Trust. *Quarterly Journal of Economics*, 115(3), 811-846.
13. Haubl, G., & Murray, K. (2003). Preference Construction and Persistence in Digital Marketplaces: The Role of Electronic Recommendation Agents. *Journal of Consumer Psychology*, 13(1&2), 75-91.
14. Haubl, G., & Murray, K. B. (2006). Double Agents: Assessing the Role of Electronic Product-Recommendation Systems. *Sloan Management Review*, 47(3), 8-12.
15. Haubl, G., & Trifts, V. (2000). Consumer decision making in online shopping environments: The effects of interactive decision aids. *Marketing Science*, 19(1), 4-21.
16. Herlocker, J., Konstan, J. A., & Riedl, J. (2000, December 2-6). *Explaining Collaborative Filtering Recommendations*. Paper presented at the Proceedings of the 2000 ACM Conference on Computer Supported Cooperative Work, Philadelphia, PA.
17. Hertzum, M., Andersen, H. H. K., Andersen, V., & Hansen, C. B. (2002). Trust in information sources: Seeking information from people, documents, and virtual agents. *Interacting with Computers*, 14(6), 575-599.
18. Hill, D. J., King, M. F., & Cohen, E. (1996). The perceived utility of information presented via electronic decision aids: A consumer perspective. *Journal of Consumer Policy*, 19, 137-166.
19. King, M. F., & Hill, D. J. (1994). Electronic decision aids: Integration of a consumer perspective. *Journal of Consumer Policy*, 17(2), 181-206.
20. Komiak, S. X., Wang, W., & Benbasat, I. (2005, January 3-6). *Comparing customer trust in virtual salespersons with customer trust in human salespersons*. Paper presented at the Proceedings of the 38th Hawaii International Conference on System Sciences, Big Island, Hawaii.
21. Lewicki, R. J., McAllister, D. J., & Bies, R. J. (1998). Trust and distrust: New relationships and realities., *Academy of Management Review* (Vol. 23, pp. 438): Academy of Management.
22. Maes, P. (1994). Agents that Reduce Work and Information Overload. *Communications of the ACM*, 37(7), 31-40.
23. Meyers-Levy, J., & Sternthal, B. (1991). Gender Differences in the Use of Message Cues and Judgments. *Journal of Marketing Research*, 28(1), 84-96.
24. Moore, G., & Benbasat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting and Information Technology Innovation. *Information Systems Research*, 2(3), 192-222.
25. Nickerson, R. S. (1999). Why interactive computer systems are sometimes not used by people who might benefit from them. *International Journal of Human-Computer Studies*, 51, 307-321.
26. Powell, M., & Ansic, D. (1997). Gender differences in risk behaviour in financial decision-making: An experimental analysis. *Journal of Economic Psychology*, 18(6), 605-628.

27. Riedl, R., Hubert, M., & Kenning, P. (2010). Are there neural gender differences in online trust? An fMRI study on the perceived trustworthiness of eBay offers. *MIS Quarterly*, 34(2), 397-428.
28. Rosenthal, P. I. (1971). Specificity, verifiability, and message credibility. *Quarterly Journal of Speech*, 57, 393-401.
29. Sheehan, K. B. (1999). An Investigation of Gender Differences in On-Line Privacy Concerns and Resultant Behaviors. *Journal of Direct Marketing*, 13(4), 24-38.
30. Shi, N., Cheung, C. M. K., Lee, M. K. O., Chen, H., Lytras, M. D., Ordonez de Pablos, P., et al. (2009). Gender Differences in the Continuance of Online Social Networks
31. Best Practices for the Knowledge Society. Knowledge, Learning, Development and Technology for All (Vol. 49, pp. 216-225): Springer Berlin Heidelberg.
32. Sinha, R., & Swearingen, K. (2002, April 20-25). *The Role of Transparency in Recommender Systems*. Paper presented at the CHI 2002 Extended Abstracts on Human Factors in Computing Systems, Minneapolis, MN.
33. Snijders, C., & Keren, G. (1999). Determinants of Trust. In D. Budescu, I. Erev & R. Zwick (Eds.), *Games and Human Behavior* (pp. 355-386). Mahwah, NJ: Lawrence Erlbaum Associates.
34. Steffen, T. M., & Nystrom, P. C. (1988). Problem Solving by Hospital Managers. *Health Care Management Review*, 13, 25-32.
35. Van Slyke, C., C., C. L., & Belanger, F. (2002). Gender differences in perceptions of web-based shopping. *Communications of the ACM*, 45(8), 82-86.
36. Venkatesh, V., Morris, M. G., & Ackerman, P. L. (2000). A longitudinal field investigation of gender differences in individual technology adoption decision-making processes. *Organizational Behavior and Human Decision Processes*, 83(1), 33-60.
37. Wang, W. (2005). *Design of Trustworthy Online Recommendation Agents: Explanation Facilities and Decision Strategy Support*. Unpublished Doctoral Dissertation, University of British Columbia, Vancouver.
38. Wang, W., & Benbasat, I. (2004). *Trust and distrust building processes in online recommendation agents: A process-tracing analysis*. Unpublished Working Paper 04-MIS-003, University of British Columbia, Vancouver, BC.
39. Wang, W., & Benbasat, I. (2005). Trust In and Adoption of Online Recommendation Agents. *JAIS*, 6(3).
40. Wolin, L. D., & Korgaonkar, P. (2003). Web Advertising: Gender Differences in Beliefs, Attitudes, and Behavior. *Internet Research: Electronic Networking Applications and Policy*, 13(5), 375-385.
41. Xiao, B., & Benbasat, I. (2007). E-Commerce Product Recommendation Agents: Use, Characteristics, and Impact. *MIS Quarterly*, 31(1), 137-209.
42. Xiao, B., & Benbasat, I. (2010). An empirical investigation of the vulnerability of consumers to personalized vs non-personalized order manipulation in online buying. Unpublished Unpublished working Paper.
43. Zhang, K. Z. K., Lee, M. K. O., Cheung, C. M. K., & Chen, H. (2009). Understanding the role of gender in bloggers' switching behavior. *Decision Support Systems*, 47(4), 540-546.

Appendix 1 Experimental Manipulations

The following illustrates an example recommendation listing page of a PRA with both internal verification mechanism (i.e., Explanation) and external verification mechanism (i.e., Search Products by Brand and Compare).

Your Shopping Advisor's Recommendations.

Search Products by Brand

View Comparison Matrix

Item #	Brand	Orig. Price	Discount Price
2712110	Fuji	\$150	\$127.5
2128108	Fuji	\$165	\$140.25

The screenshot shows a shopping advisor interface. At the top, there is a search bar with a dropdown menu for brands (Casio, Fuji, Kodak, Nikon, Olympus, Panasonic, Pentax, Samsung) and a search button. Below the search bar, there are two camera items listed. Each item has a photo, item number, brand, original price, and discount price. There are also buttons for 'More info', 'Compare', and 'Explanation'. Red circles highlight the brand dropdown menu, the 'Explanation' buttons, and the 'Compare' button.

Appendix 2

Manipulation Check for Explanation Facility and Verification Mechanism

- The Shopping Advisor offers functionalities for users to search products by brand (i.e., allow users to select a particular brand and view all the products in that brand)
- The Shopping Advisor offers functionalities for users to cross-compare different products
- The Shopping Advisor provides explanations as to how its recommendations are provided