

CREATING MORE CREDIBLE AND LIKABLE TRAVEL RECOMMENDER  
SYSTEMS: THE INFLUENCE OF VIRTUAL AGENTS ON  
TRAVEL RECOMMENDER SYSTEM EVALUATION

A Dissertation

by

KYUNG HYAN YOO

Submitted to the Office of Graduate Studies of  
Texas A&M University  
in partial fulfillment of the requirements for the degree of  
DOCTOR OF PHILOSOPHY

May 2010

Major Subject: Recreation Park and Tourism Sciences

Creating More Credible and Likable Travel Recommender Systems: The Influence of  
Virtual Agents on Travel Recommender System Evaluations

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Major Subject: Recreation, Park, and Tourism Sciences

## ABSTRACT

Creating More Credible and Likable Travel Recommender Systems: The Influence of  
Virtual Agents on Travel Recommender System Evaluation. (May 2010)

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To help online trip planners, some online travel agencies and travel service providers have adopted travel recommender systems. Although these systems are expected to support travelers in complex decision-making processes, they are not used efficiently by travelers due to a lack of confidence in the recommendations they provide (Moulin et al., 2002). It is important to examine factors that can influence the likelihood of recommendations to be accepted and integrated into decision-making processes. The persuasion literature suggests that people are more likely to accept recommendations from credible and likable sources. It has also been found that technologies can be more credible and likable when they give a variety of social cues that elicit social responses from their human users (Fogg, 2003; Nass & Moon, 2000). Thus, it is argued that enhancing the social aspects of travel recommender systems is important to create more persuasive systems.

One approach to enhancing the social presence of recommender systems is to use a virtual agent. Current travel recommender systems use various types of virtual

agents. However, it is still not clear how those virtual agents are perceived by travel recommender system users and influence users' system evaluations and interactions with these systems. Consequently, this dissertation aimed to investigate the influence of virtual agents presented in travel recommender systems on system users' perceptions. Specifically, the virtual agents' anthropomorphism as well as similarity and authority cues on system users' perceptions of system credibility and liking were examined.

For this purpose, two experiments were conducted. For Study 1, the impacts of anthropomorphism of the virtual agents on users' perceptions of virtual agents as well as recommender systems in terms of credibility and attractiveness/liking were examined. Anthropomorphism was manipulated with visual human appearance and voice output. Study 2 tested the influence of virtual agents' similarity and authority on travel recommender system users' perceptions of virtual agents and system credibility and attractiveness/liking. Similarity and authority of the virtual agent were tested by manipulating nonverbal cues (age and outfit) of the agent.

The results showed that the characteristics of virtual agents have some influences on system users' perceptions of virtual agents as well as recommender systems. Specifically, a human-like appearance of the virtual agent is found to positively influence users' perceived attractiveness of the virtual agent while voice outputs were found to enhance users' liking of the system (Study 1). Findings also indicate that RS users' perceptions of virtual agent expertise are increased when virtual agents wear a uniform rather than a casual outfit (Study 2). In addition, system users' perceptions of the virtual agent's credibility are found to have a significant influence on users'

perceived credibility and liking of the overall system, which implies an important role of virtual agents in recommender system evaluations. Further, perceived credibility and liking of recommender systems lead to favorable evaluations of the recommendations, which, in turn, increase users' intentions to travel to the recommended destination.

Past travel recommender system studies have largely neglected the social role of recommender systems as advice givers. Also, it is not clear whether the specific characteristics of virtual agents presented as a part of the system interface influence system users' perceptions. This dissertation sought to close this knowledge gap. By applying classic interpersonal communication theories to human and system relationships, this dissertation expands the scope of traditional theories used in the context of studying recommender systems. Further, the results of the research presented in this dissertation provide insights for tourism marketing as well as practical implications for travel recommender system design.

DEDICATION

*To my parents*

## ACKNOWLEDGEMENTS

Though only my name appears on the cover of this dissertation, a great many people have contributed to this work. First, I thank my committee chair, Dr. Ulrike Gretzel, for her guidance, support and inspiration. She is not just an academic advisor but a “mother” in my academic life. She has inspired me to get interested in the research, has guided my every step during the course of this research, and has taught me how to gain the analytical perspective needed to see and understand the world. I cannot forget the times and conversations we shared together as we discussed the research questions, the projects and also, our personal lives.

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## CHAPTER I

### INTRODUCTION

#### **Research Background**

The advent of the Internet has led to an explosion of information and has fundamentally changed tourists' information search behaviors (Cai, Feng & Breiter, 2004). The Internet has become an important travel information source and the number of travelers who use the Internet for travel planning has grown rapidly. However, it is often difficult for trip planners to find relevant information in digital environments (Pan & Fesenmaier, 2002) and too much information can cause confusion, information overload (Henry, 2005), and even frustration (Liao, 2005). Fortunately, recent advances in information technologies such as search engines and recommender systems can help online users reduce information overload and facilitate their decision-making process. Recommender systems are software tools that make recommendations based on learned information about a user's preferences (Häubl & Trifts, 2000). The role played by recommender systems is similar to human salespersons in physical stores who interact with consumers and advise consumers what to buy (Komiak & Benbasat, 2004; Komiak, Wang & Benbasat, 2005). Thus, recommender systems can be considered to be one way for marketers to enhance their e-services.

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This dissertation follows the style of *Tourism Management*.



In the context of tourism, the role of such systems is even more essential considering the extensive amounts of tourism-related information available online and the experiential nature of tourism products (Gretzel & Fesenmaier, 2003; Oh, Fiore & Jeoung, 2007). A recent study conducted by eMarketer (2008a) found that the number of travelers booking their trips online has recently decreased even though online travel sales are growing. The reason is travelers are often frustrated with the planning and booking capabilities of online travel agencies and, consequently, turn back to traditional travel agencies for their expertise and personalized services (eMarketer, 2008a). To overcome this disadvantage, some online travel agencies and travel service providers have adopted travel recommender systems to support travelers' trip planning. For example, Hotel.com introduced "The Visualiser" that recommends hotel and vacation destinations based on travelers' selection of a series of photos that depict hotel room style, vacation activities and feelings they want to have on their trips (<http://hotels.visualdna.com/>). The Home and Abroad website helps travelers plan their trips by suggesting a travel itinerary after travelers provide their travel information and preferred attractions and activities. The online travel agency Travelocity also provides a decision aid system, Experiencefinder, that suggests travel destinations and packages based on users' travel preferences (<http://www.travelocity.com/experiencefinder>). In addition, the Warmbad-Villach resort in Austria developed a recommender system, "VIBE," which is a virtual spa advisor that helps the visitors find customized spa products (<http://www.warmbad.at>). Such travel recommender systems are considered to be critical in supporting online travel

information search and decision-making processes as they help mimic the services provided by human assistants in brick-and-mortar travel agencies.

### **Problem Statement and Research Questions**

Although recommender systems are increasingly used by many websites to provide personalized recommendations and also to enhance online shopping experiences of consumers, recent studies indicate that often these systems are not used efficiently by decision makers. Moulin and his colleagues (2002) explained that online users do not use recommender systems because of a lack of confidence in the recommendations they provide. Also, a recent survey by ChoiceStream (2009) found that more than one-half (59%) of Internet users were not happy with the product recommendations they received at e-commerce sites. Thus, it is important for recommender system research and design to examine factors that can influence the likelihood of recommendations to be accepted and integrated into decision-making processes (Gretzel & Fesenmaier, 2006). The persuasion literature suggests that people more likely accept recommendations from credible and likable sources (O'Keefe, 2002). Fogg (2003) argued that source credibility also matters when computers take on an advisory role. This implies that the perceived credibility and perceived liking of the recommender system would be important factors that influence a user's likelihood to accept recommendations. This notion generates the first series of research questions for this dissertation:

- Do the findings in human-human advice seeking relationships apply to situations in which the advice-giver is a recommender system?

- If so, are the source characteristics that have been identified as influential in human-human relationships equally important in human-recommender system interactions?
- Are there any additional source characteristics that might not be prominent in influencing advice seeking relationships among human actors, but are important aspects to be considered in the realm of recommender systems?

Recent studies have proposed that computer-based help systems can be more persuasive when computer agents give a variety of social cues that elicit social responses from their human users (Fogg, 2003; Nass & Moon, 2000). The rationale behind this argument is that agents endowed with social cues invoke a social schema, thereby softening the interaction with seemingly cold hardware (David et al., 2007). One approach to increasing the social aspects of recommender systems is to use a virtual agent. Virtual agents can serve as personal shopping assistants, website guides or conversation partners (Holzwarth, Janiszewski, & Neumann, 2006). In recommender system contexts, virtual agents are used as system representatives. Virtual agents used in the context of travel recommender systems include an animated suitcase image in the case of [hungrysuitcase.com](http://hungrysuitcase.com), an artistic rendering of a woman in [homeandabroad.com](http://homeandabroad.com), and a photographic image of a woman in VIBE (<http://www.warmbad.at>). However, it is not clear how those virtual agents are perceived by travel recommender system users and if and how they influence users' interactions with these systems.

Further, it has not been investigated whether a virtual agent presented as part of the system interface influences users' evaluations of the recommender system as a whole,

not just of the virtual agent itself. In other words, the question is whether recommender system users distinguish the virtual agent from the system or if they personify it and evaluate the system based on the virtual agent. Previous research supports that the characteristics of the spokesperson in advertisements influence consumers' perceptions of the advertisement (Goldsmith et al., 2000; Lafferty & Goldsmith, 1999). Since virtual agents in recommender systems take on a similar role as a spokesperson in advertising, it implies that there could be impacts of virtual agents on system evaluations. Also, a recent study conducted by Qiu (2006) provides some evidence of the impacts of virtual agents on system-user interactions. It is thus believed to be important to investigate how the design and use of virtual agents in travel recommender systems influence users' perceptions. Issues associated with the design and use of virtual agents in recommender systems raise the second series of questions.

- Do virtual agents influence users' perceptions of the system?
- Is the influence of virtual agents based on specific virtual agent characteristics?
- If virtual agents' characteristics matter, what characteristics have the greatest influence on perceptions of virtual agents as well as on perceptions of system credibility, liking and attractiveness?

### **Purpose of the Study**

To address the above issues this dissertation aims to investigate the following. First, it seeks to find out if the theories conceptualized for human-human advice seeking relationships apply to human and travel recommender system relationships. Second, the

impacts of virtual agents' characteristics presented in travel recommender system interfaces on system users' perceptions of virtual agents as well as the overall system are investigated. In particular, the influences of the virtual agent's anthropomorphism, similarity and authority cues on system users' evaluations of agents as well as recommender systems in terms of credibility and attractiveness/liking are examined. Finally, this dissertation seeks to understand whether perceived credibility and liking of the recommender system influence system users' recommendation evaluations and eventually their intentions to accept advice from the system and travel to the recommended destination.

### **Overview of Dissertation**

This dissertation seeks to investigate the role of virtual agents (VA) in making travel recommender systems more persuasive. The dissertation consists of six chapters including this introduction chapter. The remainder of the dissertation is structured as follows:

Chapter II provides the theoretical background of this dissertation and also summarizes the important findings of previous research relevant to this dissertation. It first discusses the main theories that provide the theoretical foundations of this dissertation including Persuasion theory, Expectation Status theory and Media Equation theory. Next it provides the definitions and a general taxonomy of recommender systems to situate the specific kind of recommender system used for this study within currently existing types

of decision aids. The importance of recommender systems in tourism as well as the unique aspects of travel recommender systems are also outlined. In addition, the role of virtual agents used in computing technology, in particular, in recommender system is discussed.

Chapter III provides the overall conceptual framework of this dissertation and discusses the relevant concepts as well as their relationships. The specific characteristics of virtual agents tested in this dissertation are introduced and their influences on travel recommender system users' perceptions are addressed. This chapter also discusses research on recommender system evaluations and suggests new approaches to evaluate recommender systems in terms of credibility and liking based on persuasion theory.

Chapter IV describes the overall methodology used in this dissertation. It outlines the study context and briefly explains the two laboratory experiments conducted. Additionally, pre-test results that evaluated the recommendation, the overall study design, as well as the measurement scales are summarized.

Chapter V presents the first experiment of this dissertation which investigates the effects of anthropomorphism of virtual agents on system users' perceptions of virtual agents and recommender systems. Previous findings regarding the effects of two anthropomorphic cues, human-like appearance and voice output, are reviewed and hypotheses are generated. The conceptual model that illustrates the hypothesized relationships between

virtual agents' anthropomorphic cues and the evaluations of virtual agents and recommender systems are presented. Study design, procedure, participants and findings are also reported.

Chapter VI describes the second experiment conducted in the context of this dissertation, which focuses on the virtual agents' nonverbal similarity and authority cues. Two nonverbal cues, outfit and age, are tested in terms of their influence on users' perceptions when evaluating virtual agents and recommender systems regarding their credibility and attractiveness/liking. Hypotheses are generated based on previous research regarding the effects of outfit and age. The conceptual model illustrates the hypothesized relationships between virtual agents' nonverbal cues and users' evaluations of virtual agents and recommender systems. Study design, procedures as well as findings are discussed.

Chapter VII reviews the dissertations' main findings and discusses theoretical and practical implications. The chapter also reflects on the limitations of the study and outlines possible directions for future research.

## CHAPTER II

### THEORETICAL BACKGROUND

#### **Theoretical Frameworks**

The proposed research questions were addressed based on the following three theoretical and conceptual frameworks: Source factors in Persuasion, Expectation States Theory and Media Equation Theory.

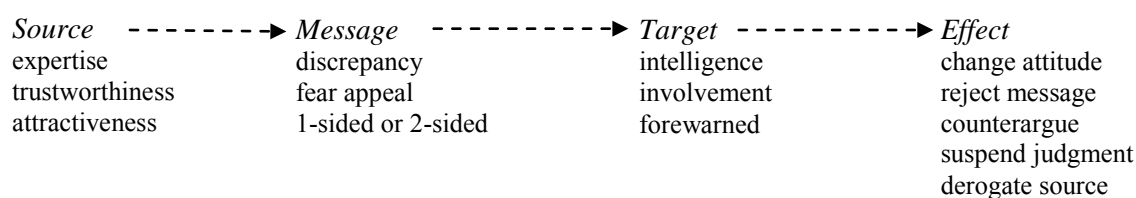
#### *Source Factors in Persuasion*

Not all recommendations are equally influential. A recommendation is persuasive when it results in attitude or behavior change. The extent to which a recommendation influences its receiver depends on 1) its form and content; 2) its source; 3) its receiver and his/her characteristics and 4) contextual factors such as product type and time constraints (O'Keefe, 2002). These factors are fundamental components in the persuasion paradigm and are interrelated with each other in persuasion processes (Michener, DeLamater, & Myers, 2004). (See figure 1)

Not surprisingly, many researchers have focused considerable attention on the question of how various characteristics of the communicator influence the outcomes of the communicators' persuasive efforts (O'Keefe, 2002). Numerous empirical investigations have found that a communicator's message is more persuasive when the communicator is perceived as credible and likeable by the message receiver (Andersen & Clevenger, 1963; Atkin & Block, 1983; Baker & Churchill, 1977; Friedman & Friedman,



1979; Hovland & Weiss, 1951; Kelman & Hovland, 1953; Patzer, 1983). For example, Hovland and Weiss (1951) found that message receivers changed their opinions in the direction advocated by the communicator in a significantly greater number of cases when the suggestion was made by a highly credible source in comparison to a low credible source. Atkin and Block (1983) also showed that consumers evaluated a product more favorably when it was advertised by a famous celebrity perceived as more credible and attractive than a non-celebrity endorser.



**Figure 1.** The Communication-Persuasion Paradigm (adapted from Michener et al., 2004)

While a good deal of studies have focused on source credibility and liking (e.g., Eagly & Chaiken, 1975; Giffen & Ehrlich, 1963; Greenberg & Miller, 1966; Husek, 1965; O’Keefe, 2002; Petty, Cacioppo, & Goldman, 1981; Sampson & Insko, 1964), other influential source characteristics have also been identified and tested. For example, source attractiveness has been considered one of the most powerful drivers of persuasion (Burgoon et al, 2002; Levin, 2003; O’Keefe, 2002). Existing research indicates that heightened physical attractiveness generally enhances one’s effectiveness as a social influence agent (Cialdini, 1994; O’Keefe, 2002) by enhancing perceived argument

quality (Norman, 1976), source expertise (Chaiken, 1979), and trustworthiness (Norman, 1976). The belief that greater similarity leads to greater communication effectiveness (O'Keefe, 2002) has also been argued in many studies. Both Heider's balance theory (1958) and Byrne's similarity theory (1971) suggest that similarity between a communicator and a message receiver tends to increase perceived attractiveness and liking of the source, thus in turn, making the source more persuasive. However, the effects of similarity on persuasive outcomes have been found to be rather complex and indirect. Source-receiver similarity has been found to enhance persuasive effectiveness under some conditions but to inhibit it under other circumstances (e.g. Goethals & Nelson, 1973; Mills & Kimble, 1973), thus a single easy generalization should be avoided (O'Keefe, 2002). The impacts of authority have also been discussed in a number of studies. Many researchers have argued that people often obey people who simply display symbols of authority (Fogg, 2003; Levine, 2003; Rhoads & Cialdini, 2002). A positive relationship between source authority and perceived credibility has been suggested in a number of previous studies (Burgoon et al., 1990; Keating & Heltman, 1994; Levine, 2003). In addition, source friendliness has been found to enhance perceptions of source liking (Byrne & Rhamey, 1965; Rhoads & Cialdini, 2002) while caring has been found to positively influence perceptions of a communicator's trustworthiness (Delgado-Ballester, 2004) and credibility (Perloff, 2003). Familiarity of the source has also been found to increase the liking of the source (Levine, 2003; Cialdini, 1994; Shavitt & Brock, 1994) and lead to persuasive outcomes (Cialdini, 1993). Further, the positive effects of humor on a message receivers' liking for the

communicator, and thus occasionally the trustworthiness of the communicator, have been investigated in some studies (Chang & Gruner, 1981; Gruner, 1967, 1970; Tamborini & Zillmann, 1981)

Recently, some source characteristics have been discussed and examined in technology-mediated communication contexts. Flanagin and Metzger (2003) noted that it is possible to translate several components of source credibility to the online environment. For example, they suggested that expertise may be communicated through the accuracy and comprehensiveness of a Web site's information, its professionalism and its sponsor's credentials while trustworthiness is associated with a Web site's integrity as demonstrated through its policy statements, use of advertising as well as firm or author reputation. Fogg (2003) also found that source credibility matters when humans interact with computers. In addition, authority cues have been found to enhance online users' credibility judgments of a computing technology (Fogg, 2003) and of online reviewers (Yoo, Lee & Gretzel, 2007). Online users have also been found to be more easily persuaded by technology that is similar to them in some way (Moon, 2002; Fogg, 2003). Some studies have found that a physically attractive virtual character was more favorably evaluated by users (Fogg, 2003) and served as a more effective sales agent (Holzwarth et al., 2006).

Fogg (2003) suggested source characteristics, in particular source credibility, are essential in human and computer interactions when computers take the role of instructing or advising computer users. Other studies (Baylor & Ryu, 2003; Flanagin & Metzger, 2008; Tseng & Fogg, 1999) have also stressed that credibility is especially important

when computers instruct or advise users. Since the role of travel recommender systems involves giving advice in online environments, traditional studies of source factors could provide an important framework to examine the interaction between users and systems as well as users' evaluations of systems.

### *Expectation States Theory*

Expectation States Theory (EST) is not a single theory, but a set of theories proposing how certain states or status characteristics organize interactions among members in task-oriented group settings (Berger, Conner, & Fisek, 1974). It begins with knowledge of social construction that explains the power of individuals, groups and institutions to shape people's perceptions and judgments of them. The general issues involved in EST are how people use information about characteristics of people to make substantive decisions.

One of the oldest and most developed theories within expectation states research is status characteristics theory (SCT) (Goar & Sell, 2005). Goar and Sell (2005) posit that SCT explains how status characteristics generate and then sustain inequalities of power and prestige. The theory further proposes that, in a task group, members form expectations regarding others' potential performance and contributions toward the group's tasks based on status characteristics they perceive such as gender, ethnicity and occupation (Michener et al., 2004). These expectations, which are formed through an attribution process, organize the interactions among members (Berger et al., 1974;

Michener et al., 2004). This process is called “status generalization process” or “The burden of proof process” (Webster & Hysom, 1998) (Figure 2).

There are two kinds of status characteristics in SCT: diffuse and specific (Berger et al., 1974; Goar & Sell, 2005; Michener et al., 2004). Diffuse status characteristics refer to “attributes that provide an indirect indication of a member’s level of ability on the group’s task” (Michener et al., 2004, p. 330). Attributes include age, gender, ethnicity and physical attractiveness. Specific characteristics are those which more directly and precisely indicate someone’s level of ability on the task, such as relevant work experience.

Initial Conditions	Inferential Link	Theoretical Construct	Observable Effects	Behavioral Outcomes
Distribution of Status Elements  (e.g. gender, skin color, age, beauty, occupation, Nobel Prizes, SAT scores)	Status Generalization Process  →	Performance Expectation States  (e.g. perceived competence at specific and general skills such as reading ability, and “most tasks”)	Translation to Behavior  →	Elements of Interaction Power & Prestige  (e.g., chances to perform, number of performances, agreement, positive evaluations, influence, and choice for leadership positions)

**Figure 2.** Status Generalization Process (adapted from Webster & Hysom, 1998)

To the best of the current author's knowledge, SCT has not been applied to understanding human and computer interaction. However, the findings of previous studies indicate that people respond socially to technologies when the technologies present social characteristics such as gender (Nass, Moon, & Green, 1997) and ethnicity

(Nass, Isbister, & Lee, 2000). These studies have revealed that when computers provide different gender voice outputs, the computer users apply gender stereotypes to evaluate the computer's ability (Nass, Moon, & Green, 1997) and also more favorably evaluate the computer that displays embodied conversational agents that match their ethnicity (Nass, Isbister, & Lee, 2000). These findings imply that the status generalization process can happen when a human interacts with a computer. Therefore, this dissertation argues that SCT provides a useful framework to understand how the characteristics of virtual agents (status elements) presented in travel recommender system interfaces influence users' evaluations of system credibility and liking (performance expectation states) and eventually their evaluations of recommendation as well as behavioral intentions to travel to the recommended destination (behavioral outcomes).

### *Media Equation Theory*

It seems obvious that a recommender system is a tool or medium, not an actor in social life. However, media equation theory suggests that individuals' interactions with computers, television, and new media are fundamentally social and natural, just like people's interactions in real life (Reeves & Nass, 1996). According to Reeves and Nass (1996), people unconsciously and automatically apply social rules when they interact with media. This theory thus argues that technologies should be understood as social actors, not just as tools or media.

Several empirical studies have supported this notion of computer as social actors. For example, a number of studies (Nass, Isbister, & Lee 2000; Nass, Moon, & Green,

1997) have found that people apply gender and ethnicity stereotypes to computers. Nass and his colleagues (1997) found that people evaluated a computer as significantly more competent when it provided tutoring with a male voice rather than a female voice. They also found that the female-voiced computer was rated as a better teacher than a male-voiced computer when the computer discussed love and relationships which is a stereotypically female topic, but rated it as a worse teacher when it talked about computers, which is a stereotypically male topic. Other studies (Nass, Isbister & Lee, 2000; Qiu, 2006) have found that computer users perceived same-ethnicity embodied computer agents as more attractive, trustworthy, persuasive, and intelligent than different-ethnicity agents.

The findings of Fogg and Nass (1997) also revealed that people exhibit social behaviors such as politeness and reciprocity toward computers. In their experiment, study participants worked with computers to learn about some facts and then were asked to evaluate the computer that they used. Half of the participants were asked to evaluate the computer's performance using the same computer they just worked with while the other half answered identical questions on a different computer located on the other side of the room. The results showed that participants who answered on the same computer gave significantly more positive responses. This suggests that they showed politeness and reciprocity toward the computers they knew and worked with. In addition, Nass and Moon (2000) found that the labeling rule is also true when people interact with machines.

According to Fogg, Lee, and Marshall (2002), computers function in three basic ways: as tools, as media, and as social actors. While previous recommender system

studies largely focused on systems as tools, recent studies (Qiu, 2006; Wang & Benbasat, 2005) have argued that users often socially interact with recommender systems. Thus, the social aspects of recommender systems need to be better understood. As a consequence, understanding the social role of travel recommender systems is also needed and media equation theory provides a good theoretical framework for such research.

### **Recommender Systems (RSs)**

In online environments, consumers often seek and accept recommendations to manage the amount of information to be processed during online searches (Smith, Menon, & Sivakumar, 2005). One of the sources from which consumers can get recommendations are online recommender systems and such systems are seen as one of the fastest growing domains of Internet applications (Spiekermann & Paraschiv, 2002).

#### *Definitions and Roles*

Häubl and Trifts (2000) defined recommender systems as software tools that make recommendations based on learned information about the user's preferences. Similarly, Xiao and Benbasat (2007) defined recommender systems as "software agents that elicit the interests or preferences of individual users for products, either explicitly or implicitly, and make recommendations accordingly"(p. 137). In their most "generic" form, recommender systems are applications implemented on Websites that suggest products, new items, etc. to their users based on implicitly or explicitly gathered or inferred user preferences (Gretzel, 2004). In the literature, the terms simple filtering,



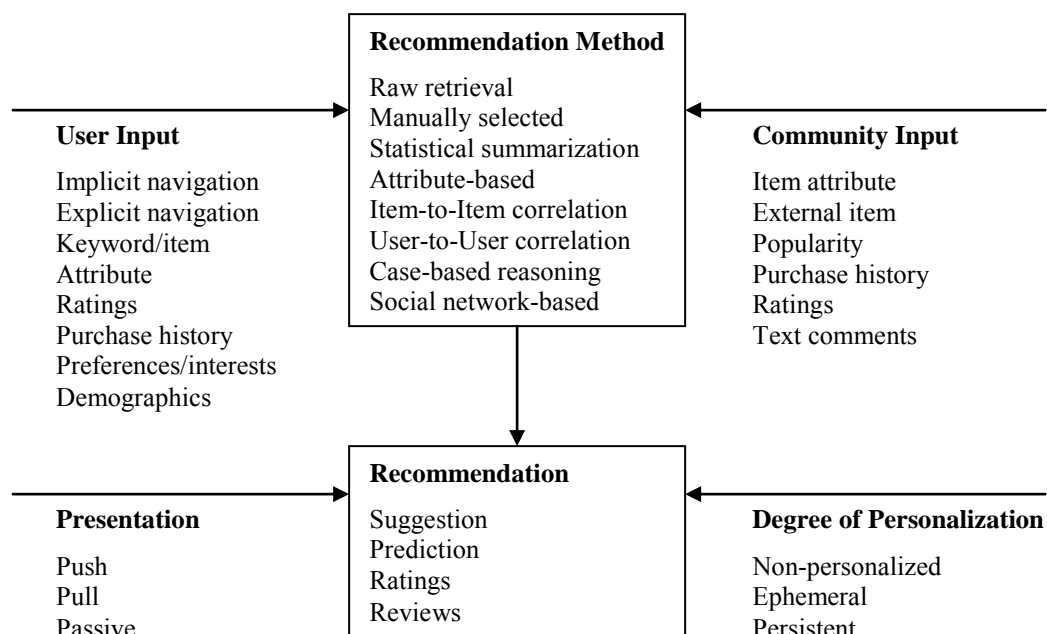
recommendation, and decision support tools are often used interchangeably (Gretzel, 2004); however, it is arguable if simple information retrieval systems should be considered as recommender systems. Burke (2002) noted that recommender systems differ from other information retrieval systems and search engines since they not only match and return all available entries that match the query but, rather, place an emphasis on relevance and usefulness. Patton (1999) also acknowledged that recommender systems promise to make shopping on the Internet better, not just by finding lower prices but by matching products to the needs and tastes of individual consumers.

Recommender systems are often classified into two categories based on the way the matching process is conceptualized: collaborative filtering and content filtering (Ansari et al., 2000; Balabanovic & Soham, 1997). Collaborative filtering systems predict a user's preferences based on a combination of other, similar people's preferences (Ansari et al., 2000; Qiu, 2006), assuming that the evaluations of others are an important information source consumers use in their decision-making process (Kim & Kim, 2001).

Content filtering systems, on the other hand, make recommendations on the basis of user preferences for product attributes (Ansari et al., 2000). This type of system usually asks users to provide information regarding attributes that are most important to their purchase decisions (Qiu, 2006) and makes recommendations based on analysis of gathered contents.

The big difference between these two types of systems is whether explicit conversations occur between the system and the user (Qiu, 2006). According to the typology of recommender systems provided by Schafer, Konstan, and Riedl (2001),

recommender systems can also be more comprehensively categorized based on the levels of sophistication, inputs used to derive recommendations, and various ways in which they present recommendations (see Figure 3). Since one of the study purposes is to understand the social interaction between the systems and users, this study focused on content filtering recommender systems that require customer input (Liao, 2005).



**Figure 3.** Taxonomy of Recommender Systems (adapted from Schafer et al., 2001)

### *Recommender Systems in Tourism*

In the tourism context, the role of recommender systems is arguably even more essential considering tourism is especially affected by the online information explosion. According to Pew Internet & American Life (2009), almost 70 percent of US internet

users have purchased or made reservations online for their travel. Further, looking for travel-related information and making travel plans are important online activities (eMarketer, 2008b). Travel recommender systems can play a vital role in travel information search processes by providing decision-support in the form of inspiration (i.e., the expansion of one's consideration set) as well as by narrowing down available alternatives (Fesenmaier, Werthner, & Wöber, 2006).

With the rising importance of providing decision support for online trip planners, ever more studies have investigated the unique aspects of travel recommender systems. Gretzel, Hwang, and Fesenmaier (2006) argued that a profound understanding of the complexities of tourists' information search and decision-making-related behaviors is fundamental for successful travel recommender system design. Ricci, Blaas, Mirzadeh, Venturini, and Werthner (2002) have developed and tested prototype systems called DieToRecs and NutKing for different travel planning stages (before a trip and en route) and insisted on the importance of adding visual cues to destination descriptions to meet the users' need of 'seeking inspiration'.

Gretzel and Fesenmaier (2002) suggested including principles of narrative design into recommender systems. They argued that travelers most often think of travel within the context of stories because of the experiential nature of tourism. Therefore, if narrative design is integrated into a travel recommender system, it may enhance the quality of the recommendations as well as improve the persuasiveness of the system.

The importance of hedonic aspects in designing travel recommender systems is also stressed by Kim and Morosan (2006). Further, Franke (2002) and Kramer as well as

Modsching, ten Hagen, and Gretzel (2006) have drawn attention to the social nature of travel that is currently not reflected in recommender systems. Specifically, Gretzel (2004) investigated whether system users' evaluations of the recommendations can be influenced by cues embedded in the preference-elicitation process of recommender systems. Recently, conversational travel recommender systems have been proposed in order to support more real and interactive processes with users (Jannach et al., 2007; Mahmood et al., 2008). These systems mimic the interactions between travelers and traditional travel agents to provide more social and personalized services to travel recommender system users.

As addressed by previous studies, travel recommender systems are unique in many aspects. They deal with much more complex, high risk, and experiential products (Gretzel et al., 2006). Also, due to the multi-faceted nature of tourism experiences, recommendations should refer to a variety of products (destinations, accommodations, attractions etc.) to provide a meaningful picture of the proposed vacation (Werthner & Ricci, 2004) The hedonic and emotional aspects of tourism and trip planning have been found to be important for travel recommender system design due to its playful consumption (Kim & Morosan, 2006). Further, en route support has been increasingly taken into account (Nguyen & Ricci, 2004). Moreover, it has been noted that predicting users' preferences is extremely challenging for travel recommender systems since variety seeking is especially pronounced in tourism (Gretzel, 2004). Consequently, the interactive process between users and travel recommender systems is believed to be especially important.

### *Recommender Systems as Social Actors*

Existing recommender system studies have viewed recommender systems as information search tools and have largely neglected their social roles in the interaction with users. However, as discussed earlier, the social aspects of technologies have been recently emphasized (Fogg, 2003; Nass & Moon, 2000; Reeves & Nass, 1996). Nass and Moon (2000) noted that the computer's social role is encouraged when the computer fills roles traditionally filled by humans and also provides words for output and interactivity.

Indeed, Wang and Benbasat (2005) found that users perceived human characteristics such as benevolence and integrity from recommender systems and treated systems as social actors. The findings by Aksoy et al. (2006) suggest that the similarity rule is also applied when humans interact with recommender systems. They found that a user is more likely to use a recommender agent when it generates recommendations in a way similar to the user's decision-making process. Morkes, Kernal, and Nass (1999) demonstrated that computer agents that use humor are rated as more likable, competent, and cooperative. In addition, trust in recommender systems has also been found to be important to support system users' decision making (Bauernfeind & Zins, 2006) as well as intentions to adopt the recommender systems (Wang & Benbasat, 2005; 2008). In addition, Gretzel (2004) revealed that the interaction process between users and recommender systems significantly influences users' perceptions of the system and the recommendations provided by such systems. Clearly, the social aspects of recommender systems are important in users' interactions with these systems.

### **Virtual Agents (VAs)**

One way of increasing the social aspects of technologies is to use virtual agents. Virtual agents are used in various ways in online environments. In many corporate websites virtual agents take the role of company representatives (Holzwarth et al., 2006). Virtual agents also serve as personal shopping assistants, website guides or software-powered interface agents such as the paperclip in Microsoft Office. In a recommender systems context, virtual embodied agents can serve as the representatives of a system that increase users' interpersonal communication experiences and, thus, emphasize the social role of the system as the advice giver.

While a number of different roles are currently available in online environments, virtual agents are understood as 2D or 3D virtual images that symbolize customer service representatives (Qiu & Benbasat, 2005) in online shopping settings. The term virtual agent also refers to a representation of an entity in a virtual world (Holzwarth et al., 2006). Virtual agents may represent a message on a website or even a bot or computer program (Oravec, 1996). In this study, virtual agents are defined as the visual representations of recommender systems presented on recommender system interfaces.

Many communication technologies use virtual agents to facilitate their interaction with users. Indeed, a number of studies have found that adding virtual agents in websites or technologies such as tutoring, e-commerce or recommender systems is beneficial to facilitating human and computer interactions. Van Mulken and colleagues (1998) demonstrated that tutoring system users more likely engage with a system and perceive the system as more useful when a virtual agent is presented on the system. Similarly,

Moundridou and Virvou (2002) found that adding a virtual agent increases engagement and perceived credibility of the system. Virtual agents have also been found to augment social interactions (Qiu, 2006) and to induce trust (Wang & Emurian, 2005). In addition, it has been reported that virtual agents in online shopping decision aid systems enhance the online shopping experience (Holzwarth et al., 2006).

Although presenting virtual agents has been found to be beneficial to enhance user-computer interaction, it is still not clear what types of virtual agents are more preferred and beneficial. Many travel recommender systems currently use various types of virtual agents in their interfaces (e.g. suitcase image in [hungrysuitcase.com](http://hungrysuitcase.com), a photographic image of a woman in VIBE, <http://www.warmbad.at>) but the impacts of these different types of virtual agents on travel recommender system users' perceptions are still unknown. Considering some studies have indicated that different types of virtual agents such as static vs. animated agents (Baylor & Ryu, 2003) or matched ethnicity vs. not-matched ethnicity agents (Nass et al., 2000; Qui, 2006) have different effects on computer users' perceptions of social presence, enjoyment or trust, it is believed relevant to identify important characteristics of virtual agents as well as their impacts on users' perceptions in a travel-recommender system context.

### **Chapter Summary**

This chapter discussed the theoretical background of this dissertation. Three theories that provide a theoretical framework for this research were introduced and the relevant findings were discussed. Influential source characteristics in traditional advice-

seeking relationships were explored and the source characteristics examined in computing technology contexts were highlighted. The status generalization process of expectation status theory was illustrated and the relevance of this theory to the dissertation research was also addressed. The notion of media equation theory and a number of supporting empirical findings were then presented. To outline the context of this research, a general taxonomy of recommender systems was provided and the roles and definitions of recommender systems were discussed. Specifically, the unique aspects of travel recommender systems and recent perspectives emphasizing the social aspects of recommender systems were noted. In addition, virtual agents' role in recommender systems was discussed

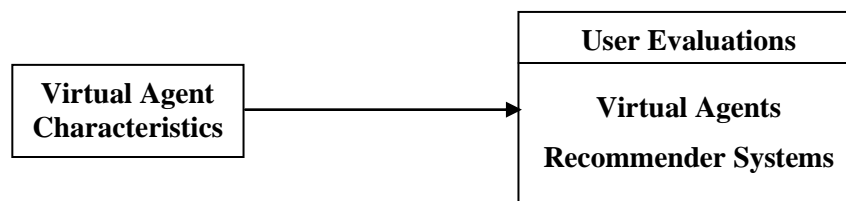


## CHAPTER III

## OVERALL CONCEPTUAL FRAMEWORK

**Influence of VA Characteristics on User's Evaluations of VAs & RSs**

Given the importance of social aspects of recommender systems and also the influential role of virtual agents in travel recommender systems, it is believed to be important to investigate how specific characteristics of virtual agents influence users' perceptions. An overall research framework (Figure 4) is thus proposed to form the basis of this research.



**Figure 4.** Overall Conceptual Framework: Influences of Virtual Agents' Characteristics on System Users' Perceptions

The following provides an overview of relevant concepts and their possible interrelationships.

*Virtual Agent (VA) Characteristics: Independent Variables*

Various characteristics of virtual agents can have an influence on perceptions of travel recommender system users. Among the many potential characteristics of virtual

agents, this study focuses on the influences of three characteristics: anthropomorphism, similarity and authority. Anthropomorphism has been identified as an influential cue in human-computer interaction research, but there is still no clear answer regarding the impact of virtual agents' anthropomorphic cues on online users' perceptions. Similarity and authority have also been found to be influential when people evaluate the sources of advice in traditional source factor literature, but these have not been sufficiently addressed in virtual agent contexts.

The importance and influences of these characteristics of virtual agents in the context of travel recommender systems are discussed in the following sections.

### Anthropomorphism

Anthropomorphism can be described as either the act of attributing humanlike characteristics to non-human organisms or objects (DiSalvo & Gemperle, 2003; Guthrie, 1997; Horowitz & Bekoff, 2007) or as the extent to which a character has either the appearance or behavioral attributes of a human being (Koda, 1996; Nowak, 2004; Nowak & Biocca, 2003; Nowak & Rauh, 2005). Anthropomorphism of nonhuman characters has been found to influence human perception processes, since categorization of environmental entities relies at a fundamental level on the differentiation between humans and nonhumans (Nowak & Rauh, 2005).

Researchers have tried to understand why humans anthropomorphize and have suggested a number of reasons. Guthrie (1997) argued that humans anthropomorphize because it allows people to explain things they do not understand in terms that they do

understand and it can also reduce humans' discomfort with things that are not like them. According to social cognitive theory, one of the basic functions of social cognition is to categorize the environment based on an entity's level of anthropomorphism in order to differentiate among inanimate objects, animals, and humans that could pose a threat or an opportunity for cooperation (Kunda, 1999). The rule of homophily, i.e. the tendency to associate with similar others (e.g. McCroskey, Richmond, & Daly, 1975; McPherson, Smith-Lovin & Cook, 2001), also supports the possible influence of anthropomorphism cues on trust building.

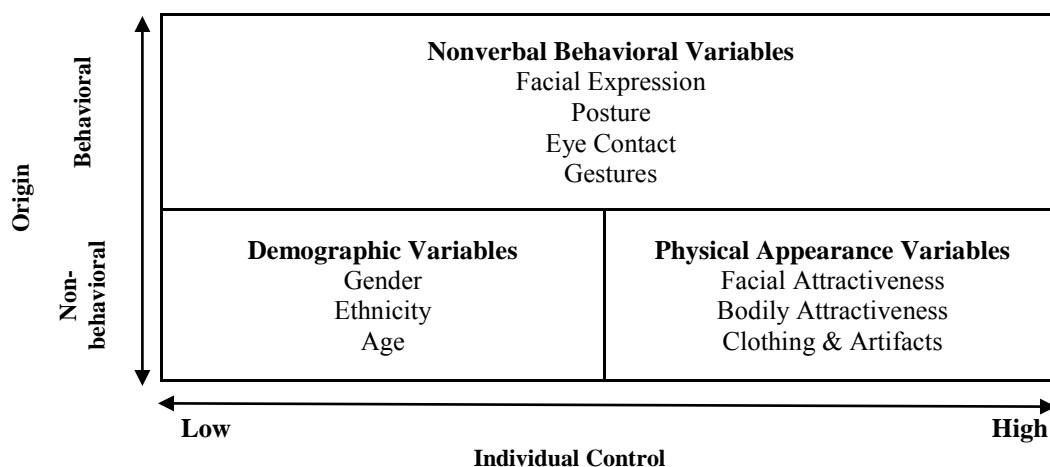
In human-computer interaction research, anthropomorphism has been suggested as an explanation for humans' social responses to computers (e.g. Barley, 1988; Turkle, 1984; Winograd & Flores, 1987). A number of previous studies have found that technologies which provide anthropomorphic cues more likely trigger social responses from users (e.g. Isbister & Nass, 2000; Jin & Bolebruch, 2009). In particular, presenting an anthropomorphic virtual character in an online setting has been identified as an important factor that influences people's interactions with computers (e.g. Koda, 1996; Nowak, 2004; Nowak & Biocca, 2003; Wexelblat, 1997). Nowak and Rauh (2005) examined how different types of virtual agents (object, animal, and human) are perceived in terms of anthropomorphism. Static virtual agents and animated virtual agents were compared by Baylor and Ryu (2003) and the influence of different levels of anthropomorphic virtual agents on social presence, telepresence, and copresence was examined by Nowak and Biocca (2003).

Yet, the findings of previous studies do not provide a clear answer for the influences of anthropomorphic virtual agents. For example, more anthropomorphic virtual agents are rated more credible, engaging, attractive and likeable than less anthropomorphic images in some studies (Koda, 1996; Nowak & Rauh, 2005) while other studies have found contrasting results (Murano, 2003; Nowak, 2004; Nowak & Biocca, 2003). Also, the voice output of virtual agents has been found to be helpful to induce social and affective responses from users in some studies (Moreno et al, 2001; Qiu, 2006) but other studies have found that sociability is higher when virtual agents only communicated with text (Sproull et al., 1996). The likely explanation for these contradictive findings is that responses to virtual agents could be different depending on the context of the interaction (Nowak & Rauh, 2005). Considering the unique aspects of travel products and travel decision-making, research is needed to examine the influence of virtual agent anthropomorphism in a travel recommender system context. In this study, virtual agents' human-like appearance and voice output will be tested to examine the influence of anthropomorphism.

### Nonverbal Cues

In the interpersonal relationship literature, influences of nonverbal cues have been acknowledged by a number of scholars (e.g., Burgoon et al, 2002; Rhoads & Cialdini, 2002). Recent recommender system studies have also found effects of virtual agents' nonverbal cues on human's perceptions (e.g. Holzwarth et al., 2006; Qiu, 2006). Importantly, these nonverbal cues often communicate similarity, attraction, power and

authority (Burgoon et al., 2002). This proposed study will focus on the influences of similarity and authority since those are generally identified as critical source characteristics that influence advice receivers' perceived credibility and liking (DeGeorge, 1985; Michener et al., 2004; O'Keefe, 2002; Wilson, 1983).



**Figure 5.** De Meuse's Taxonomy of Non-verbal Cues (Adapted from De Meuse, 1987)

According to De Meuse (1987), nonverbal cues can be categorized in a two-dimensional matrix (Figure 5). One dimension is whether the nonverbal cues are behavioral or non-behavioral. Behavioral cues include facial expressions, eye contact, posture or gesture while non-behavioral cues include demographic and physical appearance variables. The other dimension is the extent of individual control. For example, demographic cues such as gender and ethnicity are hard to be controlled and changed by individuals while physical appearance cues like outfit or physical attractiveness are more easily changed with individual control. Among these different types of nonverbal cues, this study will focus on the effects of non-behavioral nonverbal

cues to understand how these cues influence RS users' perceptions. In particular, age and outfit cues will be manipulated and tested.

*Similarity.* Research has found that people like people who are similar to them whether this similarity occurs in the area of opinions, personality traits, background, or lifestyle (Cialdini, 1994). Thus, similarity between source and receiver has been identified as an important factor that facilitates persuasion (Perloff, 2003). According to Heider's (1958) balance theory people tend to like others who exhibit signs of similarity because it is reinforcing to their own self-concept and helps them to predict and understand similar others. Byrne's similarity theory (1971) also noted that similarity increases interpersonal attraction and influences whether one individual likes another.

In the context of technology, Nass and Moon (2000) examined the impact of personality similarity on the computer user's credibility perception of computers. They created dominant and submissive computers by manipulating the language styles generated by the computer and tested if personality similarity matters when computer users rate the computer's credibility. They found that those who matched in terms of personality with the computer evaluated the computer's credibility higher than those who were dissimilar, thus supporting that the similarity rule is also applied to human and computer interactions. Aksoy et al. (2006) specifically studied the influence of similarity in a recommender system context and found that similarity in terms of the decision-making process is an important factor that makes users prefer to use a system. The similarity theory was also found to apply to virtual agents. If the virtual agent has the

same ethnicity, it has been found to be evaluated more socially attractive and perceived as providing arguments of higher quality (Nass et al., 2000). Also, individuals generally preferred to interact with a virtual agent of the same ethnicity (Baylor, 2005; Cowell & Stanney, 2005). In addition, Qiu (2006) found that recommender system users exhibited stronger trusting beliefs in the competence and integrity of a same-gender virtual agent compared to an opposite-sex one.

Suitor, Pillemer, and Keeton (1995) discussed two important categories of similarity: structural similarity and experiential similarity. While structural similarity refers to similarity based on age, gender or lifecycle, experiential similarity is based on having similar experiences. In virtual agent and human relationships, structural similarity is more applicable than experiential similarity since experiential similarity is hard to be portrayed in the virtual agent context. Thus, this dissertation focuses on the influence of a virtual agent's structural similarity on users' perceptions. In particular, the structural similarity of age and outfit will be examined since these cues have not been investigated in virtual agent research although age similarity (Goldberg, 2003; Lin et al, 1992) and outfit similarity (Burgoon et al., 2002; Butler & Roesel, 1989) have been identified as possible factors influencing source evaluations.

*Authority.* DeGorge (1985) suggests that “someone or something (X) is an authority if he (she, it) stands in relation to someone else (Y) as superior stands to inferior with respect to some realm, field, or domain (R)” (p. 14). The model emphasizes two prominent attributes of authority: The first is authority involves some type of

relational quality and the second is it is limited to a particular realm or context (Lovell, 2003). From a narrow perspective, authority is defined as “the capacity of one member to issue orders to others-that is to direct or regulate the behavior of other members by invoking rights that are vested in his or her role” (Michener et al., 2004, p. 215).

However, there are many kinds of authority (DeGeorge, 1985; Wilson, 1983). DeGeorge (1985) distinguished two types of authority: executive and nonexecutive authority. Executive authority is “the right or power of someone to do something in some realm, field or domain, in a context” (p.17) and all other authority is nonexecutive authority which does not involve any right to command or to act on or for another. Similar to DeGeorge (1985), Wilson (1983) also proposed two kinds of authority: cognitive authority and administrative authority. He defined cognitive authority as “influence on one’s thoughts that one would consciously recognize as proper” (p. 15), while administrative authority “involves a recognized right to command others, within certain prescribed limits” (p. 14). In this dissertation, authority is understood as cognitive authority and the emphasis is on how mere symbols of authority influence system users’ perceptions.

Authority is signified with many different symbols and, importantly, people often embrace the mental shortcut of assuming that people who simply display symbols of authority such as titles, tailors and tone should be listened to (Fogg, 2003; Rhoads & Cialdini, 2002). Burgoon and colleagues (2002) also discussed nonverbal expressions of power, dominance, and status such as physical appearance and technical qualities of speech as powerful cues for authority. Recently, Fogg (2003) argued that websites



displaying authority symbols such as awards or third-party endorsements can enhance their credibility. The role of authority in the context of virtual agents has not yet been examined. However, it has been found that the physical appearance of virtual agents influences human's perceptions of social presence, trust and perceived enjoyment (e.g., Moundridou & Virvou, 2002; van Mulken et al., 1998; Qiu, 2006). This indicates that a virtual agent with symbols of authority could influence recommender system users' perceptions. Consequently, this dissertation examines the influence of authority cues displayed by the virtual agent. In particular, the influences of virtual agents' outfit and age will be tested since uniform (Bickman, 1971; Burgoon et al., 1996; Burgoon et al., 2002; Joseph, 1986; Roads & Cialdini, 2002) and age (Ehrlich & Riesman, 1961; Neugarten, 1996) have been identified as important authority cues in traditional advice seeking relationships but have not been examined in virtual agent contexts.

### *Evaluation of Virtual Agents and Travel Recommender Systems*

Recommender systems have been evaluated in a number of ways. The dominant approaches are evaluating system success based on user satisfaction and technology acceptance (Wixom & Todd, 2005). Many studies have also evaluated recommender systems in terms of system accuracy (Herlocker et al., 2004). Due to the growing interests in social aspects of systems, more recent studies have evaluated the system in terms of helpfulness (Iba, 2007) and user's trust in the system (Wang & Benbasat, 2005; Xiao & Benbasat, 2007). In terms of evaluations of virtual agents, virtual characters have been evaluated in a number of ways including realism (Kang, Watt & Ala, 2008),

physical attractiveness (Jin & Bolebruch, 2009) as well as perceived enjoyment (Qiu & Benbasat, 2005).

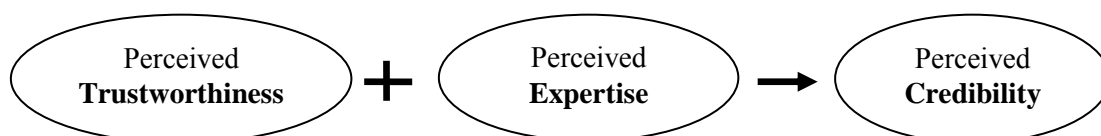
In the persuasion literature, perceived credibility and liking are identified as important criteria when people evaluate the source of advice (O'Keefe, 2002). Importantly, people more likely accept recommendations from credible and likable sources (Michener et al., 2004; O'Keefe, 2002). As Gretzel (2004) noted, the ultimate goal of every recommender system is to provide users with recommendations that will be favorably evaluated and subsequently included in their consideration set. Thus in this dissertation, the perceived credibility and liking of travel recommender systems will be measured to understand recommender system users' evaluations of systems. Also, users' perceptions of virtual agent credibility and attractiveness will be examined.

### Perceived Credibility

O'Keefe (2002) argued that credibility is not an intrinsic characteristic of a source; rather, the decision regarding a communicator's credibility depends on how the message recipient perceives the source. Thus, source credibility can be defined as judgments made by a message receiver concerning the believability of a communicator (Fogg, Lee, & Marshall, 2002). Reviews of source credibility studies by Anderson and Clevenger (1963) and McGuire (1968) concluded that a more credible source is preferred and also more persuasive. A number of recent studies confirm that source credibility is positively correlated with influence on message recipients' attitudes and behavioral

intentions as well as behaviors (Gilly et al., 1998; Harmon & Coney, 1982; Lascu et al., 1995; Sénécal & Nantel, 2004).

Credibility of information sources has also received limited attention in the realm of tourism. Kerstetter and Cho (2004) found that the perceived credibility of a travel information source is the strongest predictor for its actual usage. Similarly, Teichmann and Zins (2006) investigated the perceived credibility of travel information sources over the course of different trip stages and found differences for pretrip and posttrip contexts. Importantly, Fogg (2003) and Fogg and colleagues (2002) suggested that source credibility also matters when people interact with computers and argue that credibility is particularly important when computers give advice or provide instructions to users. Credibility has also been identified as a critical factor in the context of receiving advice from recommender systems (Swearingen & Sinha, 2001; Urban, Sultan, & Qualls, 1999; Westerink, Bakker, De Ridder, & Siepe, 2002).



**Figure 6.** Key Dimensions of Credibility (adapted from Fogg, 2003)

Credibility is described as comprising multiple dimensions (Buller & Burgoon, 1996; Gatignon & Robertson, 1991; Petty & Cacioppo, 1981; Self, 1996). Although the literature suggests various dimensions of credibility, most researchers agree that it is comprised of two key elements: trustworthiness and expertise (Fogg, 2003; Fogg et

al.,2002; O’Keefe, 2002; Rhoads & Cialdini, 2002). Figure 6 illustrates the dimensional nature of credibility.

*Trustworthiness.* Trustworthiness of a source refers to aspects such as character or personal integrity (O’Keefe, 2002). Intentions are also seen as instrumental in determining the trustworthiness of a source. A source whose intent it is to persuade is perceived as less trustworthy than one without persuasive intent (Petty & Cacioppo, 1981). Consequently, trustworthiness is often described by terms such as well-intentioned, truthful, and unbiased (Fogg et al., 2002). Mayer, Davis, and Schoorman (1995) conceptualized benevolence and integrity as dimensions of trustworthiness. Delgado-Ballester (2004) identified reliability and intentions as important trustworthiness dimensions.

Fogg (2003) identified key points that affect the perceptions of trustworthiness: 1) a source is fair and unbiased; 2) a source would argue against their own interest; and 3) a source has perceived similarity. According to O’Keefe (2002), the trustworthiness dimension is commonly represented by scales such as honest–dishonest, trustworthy–untrustworthy, just–unjust, fair–unfair, and unselfish–selfish. These items are related to the assessment of whether the communicator will likely be inclined to tell the truth (O’Keefe, 2002). In the context of recommender systems, Xiao and Benbasat (2007) proposed to test benevolence and integrity of recommender systems, with benevolence being defined as the recommender system caring about the user and acting in the user’s

interest, and integrity being described as the recommender system's adherence to a set of principles (e.g. honesty) that the user finds acceptable.

*Expertise.* Mayer et al. (1995) described expertise as the ability of a source to have influence in a certain domain. Fogg and his colleagues (2002) conceptualized it using terms such as knowledgeable, experienced, and competent; thus, this dimension seems to capture the perceived knowledge and skill of the source. Similarly, O'Keefe (2002) referred to expertise as competence, expertness, or qualification. Fogg (2003) provided many examples for cues that lead to perceptions of expertise such as labels that proclaim one as an expert, appearance cues, and documentation of accomplishments. In expertise research, this dimension is commonly represented by scales such as experienced–inexperienced, informed–uninformed, trained–untrained, qualified–unqualified, skilled–unskilled, intelligent–unintelligent, and expert–not expert (O'Keefe, 2002). These items are related to the assessment of whether the communicator is in a position to know the truth, to know what is right or correct (O'Keefe, 2002). Xiao and Benbasat (2007) described the competence of a recommender system as the system's ability, skills, and expertise to perform effectively.

O'Keefe (2002) insisted that sources are only perceived as credible if they are identified as being high in both trustworthiness and expertise. Fogg (2003) argued that trustworthiness and expertise do not necessarily go hand in hand. According to Fogg, one can perceive a source as trustworthy but without expertise and as an expert source that is not trustworthy; yet, both dimensions have to be positively evaluated for a source to be

perceived as credible. However, if one dimension of credibility is strong while the other dimension is unknown, the source still may be perceived as credible, due to the so-called “halo effect” (Fogg, 2003). However, if one dimension is known to be weak, credibility suffers, regardless of the other dimension (Fogg, 2003). Importantly, expertise and trustworthiness are conceptually distinct aspects of credibility; thus, it has been argued to be possible to manipulate and measure them separately to examine their individual effects on persuasive outcomes (O’Keefe, 2002).

### Perceived Liking

People mindlessly tend to agree with those who are seen as likable (Burgoon et al., 2002). Liking refers to the affective bond that an individual may feel toward another person (Smith et al., 2005). Research generally supports the assumption that liked communicators are more effective influence agents than are disliked communicators (Eagly & Chaiken, 1975; Giffen & Ehrlich, 1963; Sampson & Insko, 1964) and likability has been labeled a persuasion tactic and a scheme of self-presentation (Cialdini, 1994). O’Keefe (2002) stressed that enhanced liking for the source is commonly accompanied by enhanced judgments of the communicator’s trustworthiness and a number of studies have found that similarity to ourselves increases likability (Byrne, 1971; Carli et al., 1991; Hogg et al., 1993). Importantly, White (2005) found that consumers prefer advice from friends, i.e. more likable sources than experts in the case of emotional decisions. Considering that travel and tourism products are often high in emotional content (Trauer

& Ryan, 2005; Vogt & Fesenmaier, 1998), the perceived liking of travel recommender systems appears to be an important concept to investigate.

### Perceived Attractiveness

Source attractiveness has been identified as one of the important drivers of persuasion (Burgoon et al, 2002; Levin, 2003; O' Keefe, 2002). While a number of investigations have supported positive relationships between physical attractiveness of communicators and persuasive effectiveness (e.g. Horai, Naccari, & Fatoullah, 1974; Snyder & Rothbar, 1971; Widgery & Ruch, 1981), other studies have found no impacts (Maddux & Rogers, 1980) or even negative impacts (Cooper et al., 1974). There is some evidence that communicators' attractiveness influences liking for the person (Chaiken, 1986; Cacioppo & Petty, 1985) and, in turn, can influence a message receiver's judgment of communicator trustworthiness (O'Keefe, 2002). Recently some studies have tested how virtual agents' attractiveness influences people's perceptions. These findings suggest that the perceived attractiveness of virtual agents enhances the information value of the message provided by agents (Jin & Bolebruch, 2009) and also increases consumers liking of the agent (Holzwarth et al., 2006), indicating important impacts of perceived attractiveness of virtual agents. O'Keefe (2002) noted that the effects of source attractiveness on persuasive outcomes are varied depending on the type of topic and also personal relevance of the issue to the message receiver. Given the unique aspects of travel information seeking and decision-making, investigating how perceived

attractiveness of virtual agents are determined and influence system users' perceptions seems important for expanding our understanding of this concept.

### **Additional Relationships**

While the main purpose of this research is to investigate the influences of certain cues embedded in VAs on RS users' evaluations of VAs as well as the overall RS, other relevant relationships are also investigated to better understand the factors that influence RS users' perceptions and also intentions to accept recommendations.

#### *Evaluation of Recommendations*

As mentioned earlier, the ultimate goal of recommender systems is that the recommendation generated by them will be favorably evaluated and be eventually included in the user's choice set (Gretzel, 2004). In RS research, the recommendation has been evaluated in a number of different ways including accuracy (Cosley et al., 2003), usefulness, liking, trust generating potential of the recommendation (Swearingen & Sinha, 2001), persuasiveness (Liao, 2005), perceived fit with users' preference (Gretzel, 2004; Aksoy et al., 2008) as well as attitudes toward recommendations in terms of intentions to accept them (Gretzel, 2004; Holzwarth et al., 2006). In this study, the perceived fit with one's preferences, perceived attractiveness of recommendation and attitudes toward the recommendation will be measured to examine RS users' evaluations of recommendations. These concepts are measured to further examine whether these



perceptions are influenced by RS users' evaluations of the source - recommender systems - and also to see the interrelationships between these concepts.

#### Perceived Fit with Preference

Perceived fit refers to “the system user’s belief that a recommendation represents an alternative that offers what the user thinks he or she wants” (Gretzel, 2004, p. 50). This measure is suggested to be particularly relevant in the context of agent-assisted choice because participants believe that they chose an alternative that fit their preferences (Aksoy et al., 2008). Perceived fit has been found to positively influence RS system users’ attitudes as well as intention to choose the recommended destination (Gretzel, 2004).

#### Perceived Attractiveness of Destination

A good deal of travel literature suggests that travelers' destination image impacts their attitudes toward the destination as well as intentions to travel to the place (e.g. Chen & Kerstetter, 1999; Chen & Tsai, 2007; Sirgy & Su, 2000; Um & Crompton, 1990; Um, Chon & Ro, 2006). In particular, the perceived attractiveness of a destination has been suggested as an important factor that determines travelers' favorable attitudes and behavioral intentions to travel to a destination (Laws, 1995; Um & Crompton, 1990; Um, Chon & Ro, 2006).

### Attitudes toward the Recommendation

Eagly and Chaiken (1998) defined an attitude as “a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor” (p. 269). Ajzen (1991) defined an attitude as a predisposition to respond to a particular object in a generally favorable or unfavorable way, while Fazio et al. (1989) understood attitude as an association in memory between an attitude object and an evaluation. While a number of previous studies have criticized measuring attitudes to predict behaviors (Deutscher, 1966; Pager & Quillian, 2005; Wicker, 1969), others argue that capturing the cognitive and affective bases of attitudes is critical for predicting behavior (Millar & Tesser, 1986). Also, the theory of reasoned action (Fishbein & Ajzen, 1975) suggests measuring behavioral intention as the correspondence or equivalence between the attitude and the specific behavior. In TRA, the proximal cause of behavior is not attitude but an intention to engage in a behavior, which is a decision to act in a particular way. Based on these findings, this study will ask RS users’ intentions to accept the recommendation and to travel to the destination to understand their evaluations of recommendations.

### *Gender Effects*

Gender differences in terms of information processing and decision-making have been reported in a number of previous studies. Bern (1981) found that women and men use different socially-constructed cognitive structures when they encode and process information. Females were found to use a comprehensive, detailed processing strategy

whereas men tend to rely more on heuristics processing (Darley & Smith, 1995; Wolin, 2003). A study by Koc (2002) supported these findings and suggested a greater reliance of men on the credibility of a message source than women. Females were also found to be more accurate in decoding nonverbal cues (Rosenthal & DePaulo, 1979). In addition, females have been found to respond more positively to advertised brands (McDaniel & Kinney, 1998).

Men and women have also been found to be different in their computer related attitudes (Whitley, 1997). DeYoung and Spence (2004) suggested that gender differences regarding trust in technology exist. Flanagan and Metzger (2003) reported differences in the perceived credibility of Web pages, with message credibility being higher when content is rated by men. Similarly, men have been found to rate the trustworthiness of Web shopping higher than their female counterparts (Van Slyke, Comunale, & Belanger, 2002). In contrast, Fogg et al. (2001) presented results that indicate lower website credibility ratings by men.

Gender differences have been found in travel recommender system contexts as well. Gretzel (2004) revealed that women have more favorable affective attitudes, perceive greater fit, experience greater enjoyment and report more trust in recommender systems than men. Similarly, Yoo and Gretzel (2008) also found that female users tend to rate the trustworthiness of recommender systems higher and, consequently, are more likely to prefer recommender systems as a source of advice than male users. Based on these previous findings, this study will test whether the RS users' gender influences their evaluations of VAs and RSs as well as their intentions to accept the recommendation.

## **Chapter Summary**

This chapter provided an overall conceptual framework and discussed the relevant concepts as well as their relationships. The virtual agent characteristics tested in this dissertation - anthropomorphism cues and nonverbal cues that communicate similarity and authority perceptions - were introduced and their impacts on RS users' perceptions were addressed. By applying traditional interpersonal advice-seeking models, the virtual agents and travel recommender systems were evaluated in terms of source credibility and liking/attractiveness. The concepts and influences of these constructs were discussed with the review of relevant literatures. In addition, the additional influential variables and their interrelationships were explored.

## CHAPTER IV

### METHOD

The following provides an overview of the research context, research design, method and pre-tests. To investigate the influences of virtual agents on users' perceptions of virtual agents and recommender systems, two laboratory experiments were conducted. While this chapter provides an overview of the overall study design, the specific experimental designs for the two experiments are discussed in the following two chapters in greater detail.

#### **Research Context**

Recommender systems come in different shapes and forms and can be classified based on filtering methods, decision strategies or amount of support provided (Xiao & Benbasat, 2007). As mentioned earlier, since one of the dissertation purposes is to understand the social interaction between the systems and users, this dissertation specifically focuses on content filtering recommender systems that explicitly ask users to provide input regarding their preferences before a recommendation is made. However, the recommender system used in this study does not analyze the users' inputs, but rather provides the same recommendation to all users to test specifically whether particular characteristics of virtual agents presented in the system interface influence users' evaluations of the RS as well as the recommendation. While this limited context helps to test the impacts of specific characteristics of VAs on TRS users' perceptions, researchers

and practitioners should be aware of this limitation when applying the results. Further, the hypothesized relationships are tested within the context of a destination recommender system and the destination was limited to a beach destination. The hypothetical situation which was used as a task for the study participants asked RS users to search for a destination for a spring break vacation. This specific task was used to hopefully have the undergraduate sample become more involved in the experiment.

### **Research Design**

Two laboratory experiments were designed to investigate the influence of virtual agents presented in travel recommender systems on system users' perceptions of system credibility and liking. Study 1 explored the impacts of anthropomorphism of the virtual agent and Study 2 examined the impacts of similarity and authority of the virtual agent's nonverbal characteristics. Anthropomorphism of the VA was conceptualized as human-like appearance and voice output while the similarity and authority of nonverbal cues were manipulated with outfit and age of the VA. Both studies have two factors with two levels per factor, thus leading to 2 x 2 full-factorial between-subject designs. The detailed experimental designs are discussed in the following two chapters.

### **Participants and Procedures**

For both studies, participants were recruited from a University in the United States. A total of 137 and 231 college students participated in the two studies respectively for extra course credits as an incentive. Using student samples is appropriate

for this research since this study tested the fundamental psychological human process which is likely to be consistent for all humans. A number of previous studies (Basil, 1996; Sparks, 1995) noted that using student samples is appropriate for the experimentation since the chief goal of the experiment is not a generalizability of the results to the general public but, rather, it is to determine whether one variable is causally related to another. But the meta-analysis results from Peterson (2001) found the potential generalizability of research results, using college student subjects, to a nonstudent (adult) population. Further, a homogeneous group of subjects was needed since this study manipulated the cues of similarity and authority of virtual agents which required controlling the characteristics of participants for successful manipulations. The adjusted context of this study also fit the sample as it examined a designed travel recommender system which provides destination recommendations for Spring Break vacation.

More females than males participated in both studies. Since the samples consisted of college students, the participants were mostly 20-23 years old, Caucasian, and had good Internet knowledge and skills. Participants of both studies followed the same experimental procedures. Participants were asked to search for a destination for a spring break vacation using a travel recommender system developed for this study. They were randomly assigned to one of the experimental conditions and interacted with the system by answering 10 vacation preference questions. After using the system, participants were asked to take a survey that included questions of VA and RS evaluations, evaluations of the recommendation, prior travel to the recommended place, prior usage experience of travel RSs, Internet skills, the extent of travel experience and demographic information.

The detailed sample profile, experimental procedures and the survey questions used are discussed in the following chapters.

## **Measures**

The measurements of the virtual agent and travel recommender system evaluations used in the two studies were developed based on previous source factor literatures (McCroskey et al., 1973; McCroskey & Young, 1981; Newell & Goldsmith, 2001; Ohanian, 1990; O’Keefe, 2002), as well as the measurements developed for a recommender system context (Gretzel, 2004, Yoo & Gretzel, 2006; 2008). The developed measures were tested in a pilot study and a series of pre-tests.

RS users’ perceptions of VA credibility and attractiveness as well as RS credibility and liking were measured. All items were measured on a 7-point semantic differential scale. The evaluations of the system recommendation were assessed by measuring RS users’ perceived fit of the recommendation, perceived attractiveness of the recommended destination as well as their intentions to accept the recommendation. The following two chapters present the detailed measurement items and the results of factor analyses and reliability tests.

## **Analysis**

For both studies, descriptive analyses were used to describe the participants as well as their overall evaluations of VA, RS and the recommendation. One-way ANOVAs were conducted to check the manipulation and to examine gender effects. The influences



of VA characteristics on VA as well as RS evaluations were investigated with a series of two-way between-subjects ANOVAs. Further, multiple regression analyses were employed to assess the influences of the perceptions of the VA on RS evaluations as well as to examine the relationships between RS evaluations and participants' evaluations of the recommendation and intentions to accept it.

### **Pilot Study and Pre-Tests**

A pilot study to evaluate the measurement scales for RS evaluations was performed and a series of pre-tests was also conducted to test the overall experimental design.

#### *Pilot Study to Evaluate RS Evaluation Scales*

To measure users' perceived credibility and liking of travel recommender systems, measurement scales were developed based on various previous studies regarding source credibility and liking (McCroskey et al., 1973; McCroskey & Young, 1981; Newell & Goldsmith, 2001; Ohanian, 1990; O'Keefe, 2002). Source credibility scales had been specifically developed and tested in the context of a travel recommender system (Yoo & Gretzel, 2008), thus these measurement items were also reviewed and considered. A total of 9 expertise, 8 trustworthiness and 8 liking measurement items were developed. All items were measured on a 7-point semantic differential scale. To evaluate the validity and reliability of the scales as well as the applicability of the items for the recommender system context, a pilot study was conducted in April 2008 with 34

undergraduate students at Texas A&M University. A travel recommender system interface with a human VA was presented to students and they were asked to evaluate the system. They were also instructed to mark a N/A (not applicable) box if they thought the measurement item was not applicable for a travel recommender system evaluation.

*Perceived Credibility:* Based on the review of the literature (O'Keefe, 2002; Ohanian, 1990), credibility of a recommender system was conceptualized as the perceived expertise and perceived trustworthiness of a recommender system. A total of 9 perceived expertise items and 8 perceived trustworthiness items were initially developed in a pre-test. After dropping the items that more than 20 percent of respondents indicated as not applicable for recommender system credibility evaluation, 8 expertise items and 4 trustworthiness items remained. With the remaining items, separate factor analyses with Varimax rotation were conducted to evaluate the uni-dimensionality of the scales while the internal consistencies of the scales were measured using Cronbach's coefficient alpha. Based on factor loadings and Cronbach's coefficient alpha scores, two items were further excluded from the expertise scale. The results are presented in Table 1 below.

*Perceived Liking:* Among the initial 8 items, one item (sexy-not sexy) was dropped since more than 20 percent of respondents reported that the item was not applicable for evaluating recommender system liking. The remaining 7 items were factor analyzed to assess the structure of source liking. An exploratory factor analysis using Varimax rotation technique was performed. Results indicated that perceived liking has two

dimensions, perceived pleasantness and perceived attractiveness (See Table 2). To better assess the construct of perceived liking more items were developed and tested in the main study.

**Table 1.**

Scales for Perceived Credibility of Travel Recommender Systems

Construct Name & Items	Factor Loadings	Eigen Value	% of Variance	$\alpha$
<b>Perceived expertise</b>		<b>3.74</b>	<b>62.4</b>	<b><math>\alpha=.86</math></b>
Uninformed-Informed	.90			
Unintelligent-Intelligent	.83			
Unknowledgeable-Knowledgeable	.82			
Incompetent-Competent	.78			
Unskilled-Skilled	.76			
Inexpert-Expert	.63			
<b>Perceived trustworthiness</b>		<b>2.50</b>	<b>62.5</b>	<b><math>\alpha=.79</math></b>
Dishonest-Honest	.89			
Undependable-Dependable	.85			
Unreliable-Reliable	.76			
Untrustworthy-Trustworthy	.64			

**Table 2.**

Scales for Perceived Liking of Travel Recommender Systems

Construct Name & Items	Factor Loadings	Eigen Value	% of Variance	$\alpha$
<b>Perceived pleasantness</b>		<b>2.25</b>	<b>32.1</b>	<b>.75</b>
Plain-Elegant	.93			
Unpleasant-Pleasant	.77			
Unfriendly-Friendly	.72			
<b>Perceived attractiveness</b>		<b>1.85</b>	<b>26.4</b>	<b>.58</b>
Ugly-Beautiful	.79			
Unattractive-Attractive	.72			
Not nice-Nice	.61			
Not classy - Classy	.48			

*Pre-tests to Evaluate the Recommendation to Be Made by the System*

One of the goals of these pre-tests was to find a destination that was included in the awareness set of undergraduate students in the West South Central region and was perceived as being reasonably attractive by a majority of students. Also, the destination needed to be one that most students know of, but do not have first hand experience with to avoid the possible influence of prior visiting experience.

An initial pre-test was conducted in July 2008 to find spring break destinations that fit these criteria. First, popular spring break destinations for college students were searched using the Google search engine with a number of relevant keywords (e.g. spring break destination). The websites listed in the first search result pages identified a total of 28 spring break destinations. This list of destinations was presented to 17 undergraduate students in July 2008. These students were asked to rate the attractiveness of the destinations on a 5 point scale (Not at all attractive-Extremely attractive), to indicate whether they knew the destination or not and to report their prior visiting experience (See Appendix F for a copy of the survey). Results identified four destinations, well known, but not previously visited with moderately low standard deviations for the rating: 1) Acapulco, Mexico; 2) Montego Bay, Jamaica; 3) Nassau, Bahamas; and 4) Cabo San Lucas, Mexico (See Appendix G for the results). Among those, Acapulco, Mexico was selected as the destination of the recommendation based on the results of a number of interviews with undergraduate and graduate students that asked students' awareness, perceived attractiveness and visiting experience of the four destinations identified from

the pre-test. The description of the destinations was adapted from Gretzel (2004) since the description was tested and found to be equally applicable to most beach destinations.

#### *Pre-test to Evaluate the Experimental Design*

The purpose of this pre-test was to determine the specific design of the experimental conditions as well as the overall recommender system design. A beta version of a travel recommender system was developed and presented to 18 undergraduate students at Texas A&M University in July 2008 to determine the overall design of the recommender system, the vacation preference elicitation process as well as the experimental conditions. Participating students were asked to imagine that they were looking for a spring break beach destination. They were then instructed to visit the travel recommender system website and to answer all vacation preference questions. After answering all questions, the recommender system generated a destination recommendation. After receiving the recommendation, students were asked to rate the credibility and liking of the system on a 7 point Likert scale (Low-High) as well as to provide explanations for their specific evaluation. The results of this test indicated that the travel recommender system was perceived reasonably high in terms of credibility and liking (Means were expertise = 5.22, trustworthiness = 5.44 and liking = 5.94). Further, the participants did not report any problems as far as the system design and the preference elicitation process were concerned. In this pre-test, students were randomly assigned to two different experimental conditions; human virtual agent versus suitcase virtual agent. These two groups were compared in terms of their system evaluation using

T-tests. The results were not significant but followed the trend proposed in the hypotheses. The participants in the human virtual agent condition evaluated the system expertise and trustworthiness slightly higher (Mean difference = 0.22 and 0.45 respectively) while participants in the suitcase virtual agent condition rated the liking of the system slightly higher (Mean difference = 0.11). In addition, participants were asked to provide their opinions regarding what gender would be more appropriate for the agents providing travel-related recommendations. The results were as follows: 44% of participants said female agents, while 33% reported an agent whose gender matches their own gender to be more appropriate; 22% answered that it does not matter. Consequently, a female virtual agent was used for this study based on these pre-test results, literature suggesting the dominant role of females in travel information search and decision-making (Smith, 1979), and current practices that mostly use female agents as representatives of travel recommender systems.

### **Chapter Summary**

This chapter provided an overview of the research context, methodology and the results of pilot/pre-tests. The context of the research was outlined and the overall research design was explained. Participants and the procedures they were involved in were briefly described and the measures used in this research were presented. The analysis approach was then introduced and the results of a pilot study and a number of pre-tests were discussed.

## CHAPTER V

STUDY 1 -INFLUENCE OF ANTHROPOMORPHISM OF VIRTUAL AGENTS ON  
AGENT AND SYSTEM EVALUATIONS

### Conceptual Model and Hypotheses

Based on the literature reviewed and the conceptual framework developed in Chapter II, a conceptual model for Study 1 was developed (Figure 7). A total of fifteen hypotheses were derived from this model. Anthropomorphism was conceptualized as visual human-like appearance and voice output.

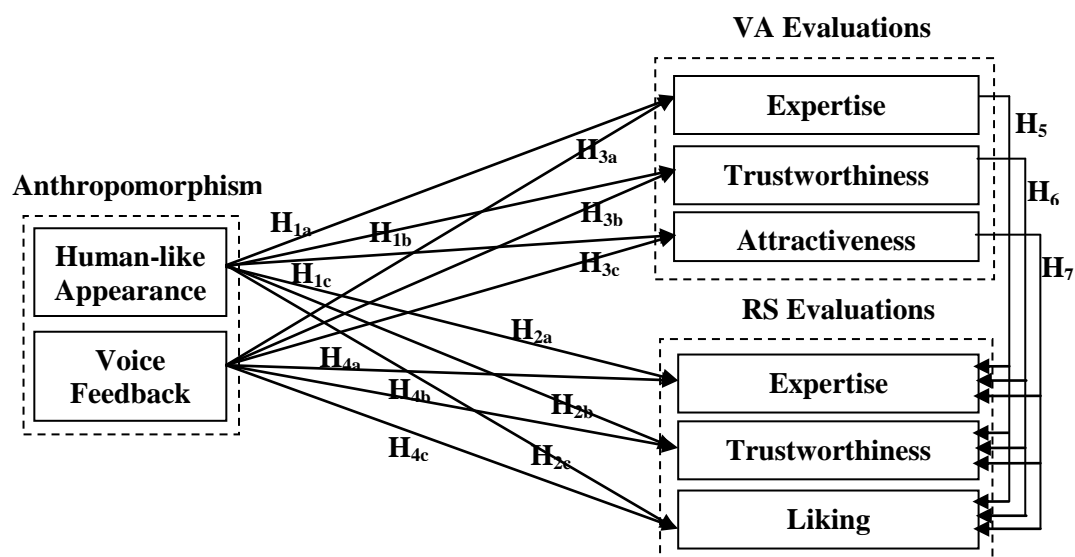


Figure 7. Study 1 Research Model

### *Effects of Human-like Appearance*

The human-like appearance of virtual agents has been found to influence people's interaction with computers (e.g. Koda, 1996; Nowak, 2004; Nowak & Biocca, 2003; Qiu & Benbasat, 2009). Many scholars have argued that users' social responses appear to be stronger with agents displaying more human-looking images (Turkel, 1995; Koda, 1996; Nass et al., 1998; Qiu & Benbasat, 2009). Qiu and Benbasat (2009) found that more anthropomorphic virtual agents increased system users' perception of social presence, which in turn enhanced users' trust and perceived enjoyment. Nowak and Rauh (2005) also found that more human-like virtual agents were perceived to be more attractive and credible, and people were more likely to choose to be represented by them in computer-mediated communication. Similarly, more anthropomorphic virtual agents have been found to be rated as more credible, engaging, likeable (Koda, 1996) as well as attractive (Jin & Bolebruch, 2009) than less anthropomorphic images. Also, human-like virtual agents are preferred when people seek information from computers (Berry et al., 2005).

Therefore, the following hypotheses are posited:

*H<sub>1a</sub>: Users will perceive greater VA expertise when a human-like VA is presented rather than an object VA.*

*H<sub>1b</sub>: Users will perceive greater VA trustworthiness when a human-like VA is presented rather than an object VA.*

*H<sub>1c</sub>: Users will perceive greater VA attractiveness when a human-like VA is presented rather than an object VA.*

*H<sub>2a</sub>: Users will perceive greater RS expertise when a human-like VA is presented rather than an object VA.*

*H<sub>2b</sub>: Users will perceive greater RS trustworthiness when a human-like VA is presented rather than an object VA.*



*H<sub>2c</sub>: Users will perceive greater RS liking when a human-like VA is presented rather than an object VA.*

### *Effects of Voice Output*

It has been found that computer users respond socially to speech interfaces and use the same rules and heuristics they would normally apply to other humans (Reeves & Nass, 1996; Nass & Brave, 2005). Nass and Brave (2005) noted that humans respond socially to all voices, whether of human or machine origin and that voice interfaces increase users' liking, trust and efficiency. Similarly, Cassell and her colleagues (2000) also pointed out the importance of speech functions of embodied agents to establish trust in users. In the recommender system context, voice output by a virtual agent has been found to be helpful in inducing social and affective responses from users and to increase perceived enjoyment (Qiu, 2006). Moreno et al. (2001) also found that voice agents increase the interests in tutoring systems. Based on these previous findings, the following hypotheses are proposed.

*H<sub>3a</sub>: Users will perceive greater VA expertise when the VA provides voice output.*

*H<sub>3b</sub>: Users will perceive greater VA trustworthiness when the VA provides voice output.*

*H<sub>3c</sub>: Users will perceive greater VA attractiveness when the VA provides voice output.*

*H<sub>4a</sub>: Users will perceive greater RS expertise when the VA provides voice output.*

*H<sub>4b</sub>: Users will perceive greater RS trustworthiness when the VA provides voice output.*

*H<sub>4c</sub>: Users will perceive greater RS liking when the VA provides voice output.*

### *Effects of Virtual Agents on Recommender System Evaluation*

Previous research supports that characteristics of the spokesperson in advertisements influence consumers' perceptions of the overall advertisement (Goldsmith et al., 2000; Lafferty & Goldsmith, 1999). Since virtual agents in recommender systems take on a similar role, this implies that there are likely impacts of virtual agents on system evaluation. Also, a recent study conducted by Qiu and Benbasat (2009) found that the anthropomorphic characteristics of interface agents significantly influence RS users' perceptions of social presence, which in turn enhances users' trusting beliefs, perceptions of enjoyment, and ultimately, their intentions to use the RS as a decision aid. Thus, taking into account likely transfer effects from the virtual "spokesperson" to the overall system, it is assumed that the evaluation of the VA impacts the evaluation of the overall system. Consequently, the following hypotheses are proposed.

*H<sub>5</sub>: Perceived VA expertise positively influences perceived RS expertise, trustworthiness & liking.*

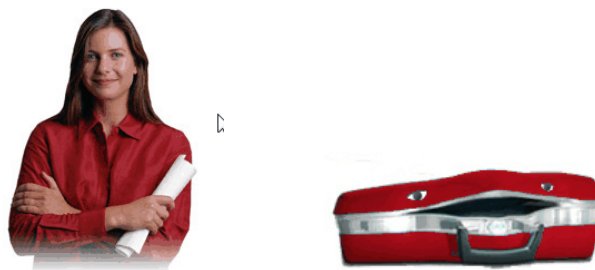
*H<sub>6</sub>: Perceived VA trustworthiness positively influences perceived RS expertise, trustworthiness & liking.*

*H<sub>7</sub>: Perceived VA attractiveness positively influences perceived RS expertise, trustworthiness & liking.*

### **Study Design**

The first experiment involved the manipulation of two factors with two levels per factor, thus leading to a 2 x 2 full-factorial between-subjects design. The first factor is human-like appearance and the second factor is voice output.

*Human-like appearance.* Human-like appearance was manipulated by including an image of a human virtual agent (high human-like appearance) versus an image of an object (suitcase; low human-like appearance) (See Figure 8). For the low human-like appearance condition, a travel suitcase was used since a suitcase has no human-like appearance indication cues, but represents a travel related object. Also, suitcases are currently used in a number of travel-related websites as a symbol and a representative (e.g. expedia.com, and hungrysuitcase.com), thus it was believed that system users would not perceive this object as irrelevant to travel recommender systems. For the high human-like appearance condition, a female virtual agent wearing a dress shirt was presented. A female image was chosen based on the results of a pre-test and women are also considered to play a dominant role in travel information search as well as travel decision-making (Smith, 1979). Further, currently available travel recommender systems use mostly female virtual agents; thus, a female was perceived to be appropriate in the context of travel recommender systems. The same colors were used for the woman's outfit and the suitcase to avoid potential color impacts.



**Figure 8.** Human Vs. Non-Human Appearance Conditions

*Voice output.* Voice output was manipulated by including voice output versus not including voice output. The same pre-recorded female voice was used for both human and suitcase conditions. In the voice output condition, the virtual agent provided verbal encouragements to subjects when they moved to the next page (See appendix A for the verbal script). Conversely, in the no verbal output condition, no voice output was generated.

Manipulation of the VA's anthropomorphism was checked with a 7 point semantic differential scale adapted from Nowark & Rauh (2005). Study participants were asked to indicate their perceptions of VA humanness (Looks very human – Does not look human).

## **Participants**

Data was collected from November 14 to December 5, 2008. A total of 137 college students in a University in the United States participated in the experiment. Course extra-credit was used as an incentive.

## **Procedures**

Participants were greeted, seated in front of a computer, and informed that a travel agency was interested in embedding a newly developed RS on its website and would like them to evaluate the system. Then, a hypothetical situation which asked them to search for a destination for a spring break vacation was explained to the subjects.

Participants were randomly assigned to one of the experimental conditions,

showing the homepage of a travel RS (See Appendix B). Participants in all conditions were asked to answer the same 10 questions aimed at capturing their vacation preferences. These questions were adapted and modified from Gretzel (2004) and the vacation personality quiz developed by the United States Tour Operators Association (USTOA) (See Appendix C).

After answering all the questions, participants were presented with the name, picture and description of a spring break vacation destination (See Appendix D). The destination was chosen based on the findings of a pilot study that aimed to identify an appropriate destination. Every participant received the same recommendation so that the variations in the evaluation of the RS would depend on the experimental conditions, not the specific characteristics of the recommended destination. The preference elicitation questions were designed so that independent of the answer to the questions, the destination would appear as a suitable solution. Study participants were then asked to evaluate the system and the VA in terms of expertise, trustworthiness and liking/attractiveness. They were also asked to indicate their prior visiting experience and perceived attractiveness of the recommended destination as well as the intention to travel to the place. In addition, the questions regarding their perceived fit of the recommendation with their preference, prior usage experience of travel RSs, Internet skills, the extent of travel experience and demographic information were asked (See Appendix E).

## Measures

For credibility measurement, the items developed in the pilot study were used. Since the liking scale results did not work well in the pilot study, items were carefully reexamined based on traditional source likeability studies (McCroskey, 1966; O'Keefe, 2002; Pearce & Brommel, 1972). While 'liking' and 'attractiveness' are related to each other, they are not the same concept (O'Keefe, 2002). To better examine system users' perceptions of 'liking', the items loaded on the attractiveness factor were not included, except for an item (Not nice-Nice) which has often been used to measure the liking of the source in previous studies. Thus, four measurement items of liking in a pilot test were included and one more item was developed (Dislikable-Likable). This resulted in a total of 6 expertise, 4 trustworthiness and 5 liking measurement items used in the study. All items were measured on a 7-point semantic differential scale (e.g. Untrustworthy-Trustworthy; Dislikable-Likable).

A confirmatory factor analysis was employed using Amos 7.0 to examine the reliability and validity of the recommender system scales as these had been previously tested. The standardized factor loadings of the items and scale reliability coefficients are presented in Table 3. All items highly loaded on corresponding factors with statistical significance. In addition, the reliability coefficients for all scales exceeded .8 which were all above the recommended level of .7 (Hair et al., 1998) and, thus, they were deemed acceptable.

**Table 3.**

Factor Loadings and Construct Reliability for RS Evaluation Measurement

<b>RS Evaluation Latent Variables &amp; Items</b>	<b>Mean</b>	<b>SD</b>	<b>Factor Loadings</b>	<b>Construct Reliability</b>
<b>Perceived Expertise</b>	<b>5.15</b>	<b>1.12</b>		<b>.94</b>
Uninformed – Informed	5.31	1.31	.87	
Unskilled - Skilled	5.12	1.35	.87	
Inexpert - Expert	4.74	1.29	.86	
Incompetent - Competent	5.26	1.22	.85	
Unintelligent – Intelligent	5.21	1.16	.84	
Unknowledgeable – Knowledgeable	5.28	1.35	.79	
<b>Perceived Trustworthiness</b>	<b>5.26</b>	<b>1.09</b>		<b>.90</b>
Undependable – Dependable	5.12	1.21	.89	
Untrustworthy – Trustworthy	5.16	1.29	.87	
Unreliable – Reliable	5.20	1.35	.89	
Dishonest - Honest	5.57	1.09	.74	
<b>Perceived Liking</b>	<b>5.67</b>	<b>0.91</b>		<b>.88</b>
Dislikable – Likable	5.80	1.04	.83	
Unpleasant – Pleasant	5.99	0.98	.82	
Not nice – Nice	6.07	1.01	.80	
Unfriendly – Friendly	6.22	0.94	.79	
Plain - Elegant	4.26	1.58	.64	

The correlations between factors were examined: correlations of .936 between expertise and trustworthiness, .673 between liking and trust, and .683 between expertise and liking were found. Brown (2006) and Kline (2005) suggested that a factor correlation over .85 questions the discriminant validity of a factor. In this case, it is suggested to respecify the model by collapsing the highly correlated factors into a single factor and to assess the model fit of the modified model (Brown, 2006). Consequently, a two factor model that collapsed expertise and trustworthiness was developed and compared with the three factor model. Model fit was evaluated on the basis of the criteria developed by Hu and Bentler (1999) in which  $CFI \geq .95$ ,  $TLI \geq .95$  and  $RMSEA \leq .06$  indicate a good model fit. The criteria suggested in other CFA studies (Brown, 2006; Kline, 2005) are also considered:  $CFI \geq .90$ ,  $TLI \geq .90$  and  $RMSEA \leq .08$  indicate a reasonable model fit.

Results suggest that the two factor model with expertise and trustworthiness items under a single factor showed a decent fit:  $\chi^2(90) = 159.076$  ( $p < .001$ ), CFI = .958, TLI = .952 and RMSEA = .075. However, on the other hand, the three factor model with separate expertise and trustworthiness factors found to have a better model fit as reported in Table 4. The two models were further compared in terms of the AIC and BIC indices. The three factor model showed smaller AIC and BIC values (AIC = 202.195, BIC = 298.554) than the two factor model (AIC = 219.076, BIC = 306.676), thus suggesting that three factors resulted in a better model fit.

**Table 4.**

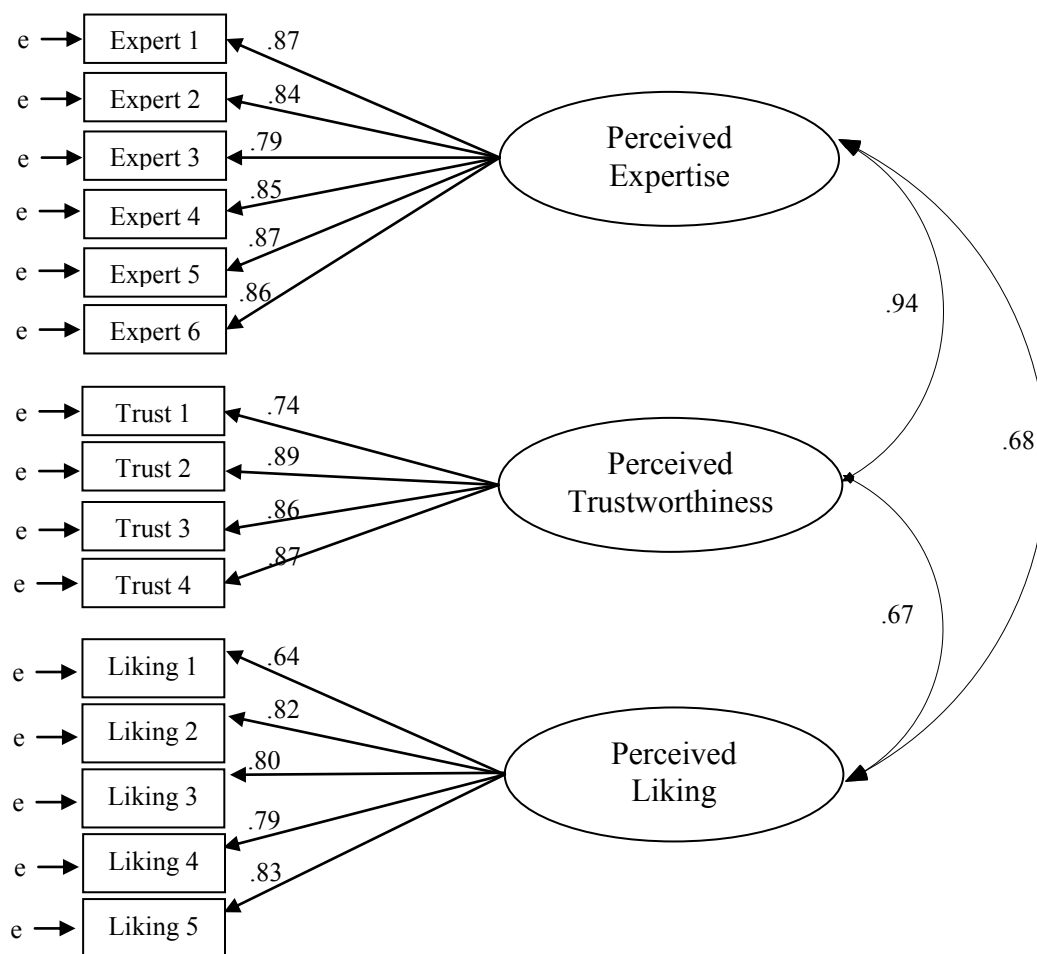
Goodness-of-Fit Indices: Factors of RS Evaluations Confirmatory Factor Analysis.

<b>Model</b>	<b>N</b>	<b>Chi-Square</b>	<b>df</b>	<b>p</b>	<b>CFI</b>	<b>TLI</b>	<b>RMSEA</b>
<b>Initial</b>	137	136.195	87	<.001	.970	.964	.064

Note: CFI = comparative fit index; TLI = Tucker-Lewis coefficient; RMSEA = root mean square error of approximation.

Not only did the model fit improve, previous source credibility studies also commonly found two dimensions of communicator credibility and suggest the two dimensions are substantively related, but represent distinct constructs of credibility (O'Keefe, 2002). Further, this study is interested in testing the effects of specific characteristics of VAs on RS users' individual perceptions of expertise and trustworthiness. Consequently, the three factor structure was used for further analyses. The three factor measurement model for RS evaluation measurement is depicted in Figure 9.





**Figure 9.** Measurement Model for RS Evaluation.

Subjects were asked the same expertise and trustworthiness measures when they evaluated the VAs. However, rather than asking them about the overall liking of the agent, the questionnaire asked respondents to specifically assess the attractiveness of the representative along 5 items (e.g. Unattractive-Attractive; Ugly-Beautiful), as this measure has typically been used for individual sources (Ohanian, 1990; Newell & Goldsmith, 2001; O’Keefe, 2002; McCroskey et al., 1973; McCroskey & Young, 1981).

Since the attractiveness measurement items were developed for human sources and tested with only human agent conditions in a pilot study, the items were further tested with 19 undergraduate students to examine whether they were appropriate for both human and suitcase VAs. Participants were asked to indicate whether they had any difficulties when they evaluated both human and suitcase agents based on 5 attractiveness measurement items. Consistent with the findings of the pilot study results, participants reported problems with answering the question that asked if the VA was sexy or not sexy while the other items were seen as appropriate. Consequently, the item was dropped from the attractiveness scale. A confirmatory factor analysis revealed that all items highly loaded on corresponding factors with statistical significance ( $P < .001$ ). In addition, the reliability alpha coefficients are above the recommended level of .7 (Hair et al., 1998) (Table 5). In terms of the model fit, CFI and TLI indices reached the recommended level but the RMSEA values suggested a poor model fit:  $\chi^2 (74) = 207.655$  ( $p < .001$ ), CFI = .926, TLI = .909 and RMSEA = .115. Since the correlation between expertise and trustworthiness factors were very high (.95), a two factor model was developed and compared with the three factor model. The model fit of the two factor model that collapsed expertise and trustworthiness was found to be poorer than the fit for the three factor model:  $\chi^2 (77) = 224.671$  ( $p < .001$ ), CFI = .918, TLI = .903 and RMSEA = .119. The two models were further compared in terms of the AIC and BIC indices. The three factor model showed smaller AIC and BIC values (AIC = 269.655, BIC = 360.174) than the two factor model (AIC = 280.671, BIC = 362.430), thus suggesting that three factors resulted in a better

model fit. Thus, three factor model was chosen to measure VA credibility and attractiveness.

**Table 5.**

Factor Loadings and Construct Reliability for VA Evaluation Measurement

VA Evaluation Construct Names & Items	Mean	SD	Factor Loadings	Construct Reliability
<b>Perceived Expertise</b>	<b>5.15</b>	<b>1.21</b>		<b>.96</b>
Unknowledgeable – Knowledgeable	5.23	1.27	.92	
Uninformed – Informed	5.35	1.32	.91	
Unskilled - Skilled	5.02	1.36	.89	
Unintelligent – Intelligent	5.26	1.28	.89	
Incompetent - Competent	5.26	1.29	.89	
Inexpert - Expert	4.80	1.41	.86	
<b>Perceived Trustworthiness</b>	<b>5.29</b>	<b>1.13</b>		<b>.91</b>
Undependable – Dependable	5.25	1.33	.93	
Unreliable – Reliable	5.17	1.33	.88	
Dishonest - Honest	5.53	1.20	.80	
Untrustworthy – Trustworthy	5.29	1.19	.76	
<b>Perceived Attractiveness</b>	<b>4.26</b>	<b>1.03</b>		<b>.80</b>
Ugly – Beautiful	4.58	1.14	.75	
Unattractive – Attractive	4.58	1.31	.74	
Plain – Elegant	4.06	1.54	.70	
Not classy - Classy	4.93	1.30	.62	

In addition, the survey included questions of system users' intention to travel, their perceived fit of the recommended destination with their preferences as well as perceived attractiveness of the destination. RS users' intention to travel was measured with three 7-point Likert scale items. Two items were adapted from a previous study (Grewal, Monroe & Krishnan, 1998) and then reworded to fit the RS context, and one item was developed specifically for the study. As shown below in Table 6, the results of an exploratory factor analysis with Varimax rotation confirmed the uni-dimensionality of the scale as well as the reliability ( $\alpha = .93$ ).

**Table 6.**

Scales for Intention to Travel to Recommended Destination

<b>Items of Intention To Travel to Recommended Destination</b>	<b>Mean</b>	<b>SD</b>	<b>Factor Loadings</b>	<b>Eigen Value</b>	<b>% of Var.</b>	<b><math>\alpha</math></b>
If you won a free Spring Break vacation, and one of the places you could go on that vacation was the one suggested by the recommender system, how would you respond to the following questions?	<b>5.91</b>	<b>1.14</b>		<b>2.64</b>	<b>87.8</b>	<b>.93</b>
I would be willing to accept the recommendation suggested by this recommender system	6.10	1.04	.95			
The probability that I would consider the recommended destination for the trip is very high	5.91	1.27	.94			
The likelihood that I would travel to the recommended destination is very high	5.72	1.33	.93			

RS users' perceived fit of the recommendation with their destination preferences was also measured with three 7-point Likert scale items, which were adapted from Gretzel (2004). The results of the factor analysis confirmed the uni-dimensionality of the scale and the Cronbach's alpha level (.93) indicated high reliability (See Table 7).

**Table 7.**

Scales for System Users' Perceived Fit of Recommendation

<b>Items of Perceived Fit of Recommendation</b>	<b>Mean</b>	<b>SD</b>	<b>Factor Loadings</b>	<b>Eigen Value</b>	<b>% of Var.</b>	<b><math>\alpha</math></b>
	<b>5.60</b>	<b>1.33</b>		<b>2.68</b>	<b>89.4</b>	<b>.94</b>
The recommended destination suits my needs.	5.69	1.37	.95			
The recommended destination reflects what I like to experience when going on vacation	5.81	1.38	.95			
The recommended destination is exactly what I want	5.29	1.46	.94			

RS users' perceived attractiveness of the destination was measured with a single question that asked how attractive the recommended destination is where responses ranged from 1 (Not at all attractive) to 7 (Extremely attractive).

## **Analysis**

Manipulation of the VAs' anthropomorphism was checked with a one-way ANOVA. Descriptive analyses were then conducted to describe the participants as well as their overall evaluations of the VA, the RS and the recommendation. The effects of specific characteristics of the VA on the evaluations of the VA as well as the RS were investigated with a series of two-way between-subjects analyses of variance (ANOVA). Gender effects were examined with a series of one-way ANOVA tests. Further, multiple regression analyses were employed to assess the influence of the perceptions of the VA on RS evaluations as well as to examine the relationships between RS evaluations and participants' intention to travel to the recommended destination, perceived fit of the recommendation, and perceived attractiveness of the recommended destination.

## **Results**

### *Manipulation Check*

To check the manipulation of anthropomorphism, a two-way between-groups ANOVA was performed. The results (Table 8) revealed that there is a significant main effect for VA's human-like appearance on RS users' perceptions of VA humanness ( $F(1, 133) = 109.87, p < .001$ ) with a large effect size (partial eta squared = .45) (Cohen, 1988). The perceptions of humanness was much higher for the human agents ( $M = 6.2, SD = .88$ ) than the suitcase agents ( $M = 3.5, SD = 1.97$ ). However, no significant main effects of voice output and no significant interaction effects were found. Although it was not statistically significant, the descriptive results suggest that the agents with voice output

( $M = 4.97$ ,  $SD = 2.11$ ) are rated slightly higher than the agents without voice output ( $M = 4.76$ ,  $SD = 1.98$ ) in terms of users' perception of agent humanness. Users' perception of VA humanness was further examined by comparing the four experimental conditions. Results showed that participants gave the highest humanness ratings for the human agent with voice output ( $M = 6.4$ ,  $SD = .85$ ). The human agent without voice output followed with a mean of 6.1 ( $SD = .90$ ). The humanness ratings of the suitcase agents were 3.59 ( $SD = 2.09$ ) with voice output and 3.41 ( $SD = 1.86$ ) without voice output thus suggesting the manipulation was successful.

**Table 8.**

Effects of Anthropomorphism Cues on RS Users' VA Humanness

<b>Humanness Perception</b>	<b>Anthropomorphism Cues of VA</b>	<b>DF</b>	<b>F</b>	<b>P-Value</b>
Perceived humanness of VA	Human-like appearance	1, 133	109.867	.000
	Voice	1, 133	.633	.428
	Appearance*Voice	1, 133	.014	.905

### *Sample Profile*

More females (68.6%) than males participated in the experiment. Since the sample consisted of college students, the participants were mostly between 20 and 23 years old (94.8%). The majority were Caucasian (80.3%) and had never used a travel RS before (95.6%). In terms of their travel experience, 78.8 percent reported to have travel experience within the United States while about 40 percent had international travel experience. Almost all of the respondents (94.2%) indicated that they had good Internet knowledge and skills.

### *Descriptive Results*

The descriptive results of the VA and RS evaluations show that participants' perceived expertise ( $M = 5.15$ ,  $SD = 1.21$ ) and trustworthiness ( $M = 5.29$ ,  $SD = 1.13$ ) of interface agents were reasonably high. Overall, the VAs were also perceived as somewhat attractive ( $M = 4.26$ ,  $SD = 1.03$ ). In terms of RS evaluations, the RS was generally evaluated as having good expertise ( $M = 5.15$ ,  $SD = 1.12$ ), being trustworthy ( $M = 5.26$ ,  $SD = 1.09$ ), and being likable ( $M = 5.67$ ,  $SD = 0.91$ ). This suggests that the experimental manipulations looked realistic and professional, and thus were not discredited by the subjects. In terms of prior visiting experience of the destination, a majority of participants (92%) reported that they had not visited the recommended destination. To test whether participants' prior visiting experience influences their evaluations of the VA and the RS as well as the recommendation, additional t-tests were conducted. No significant relationships were found, suggesting that prior experience was not an influence factor and did not have to be taken into account for further analyses. Participants' perceived attractiveness of the recommended destination was very high ( $M = 6.04$ ,  $SD = 1.28$ ) and they thought the recommendation reasonably fit with their preference ( $M = 5.60$ ,  $SD = 1.33$ ). Their overall intention to travel to the recommended destination was also high ( $M = 5.91$ ,  $SD = 1.14$ ).

### *Influences of Anthropomorphism Cues*

A series of ANOVAs were employed to test whether or not the specific anthropomorphic characteristics of VAs influence RS users' evaluations of VAs as well

as RSs. The results (Table 9) indicated a statistically significant main effect for VA's human-like appearance on users' perceptions of VA attractiveness ( $F(1,133) = 3.95$ ,  $p = .049$ ). The perceived attractiveness of the VA was higher when it was a human ( $M = 4.44$ ,  $SD = .82$ ) than a suitcase ( $M = 4.09$ ,  $SD = 1.19$ ). Despite reaching statistical significance, the actual difference in mean scores between the groups was quite small and the effect size was also small (partial eta squared = .03). No significant influence of human-like appearance on the evaluation of VA expertise as well as trustworthiness was found. Also, no significant main effects of voice output and no significant interaction effects were found.

**Table 9.**

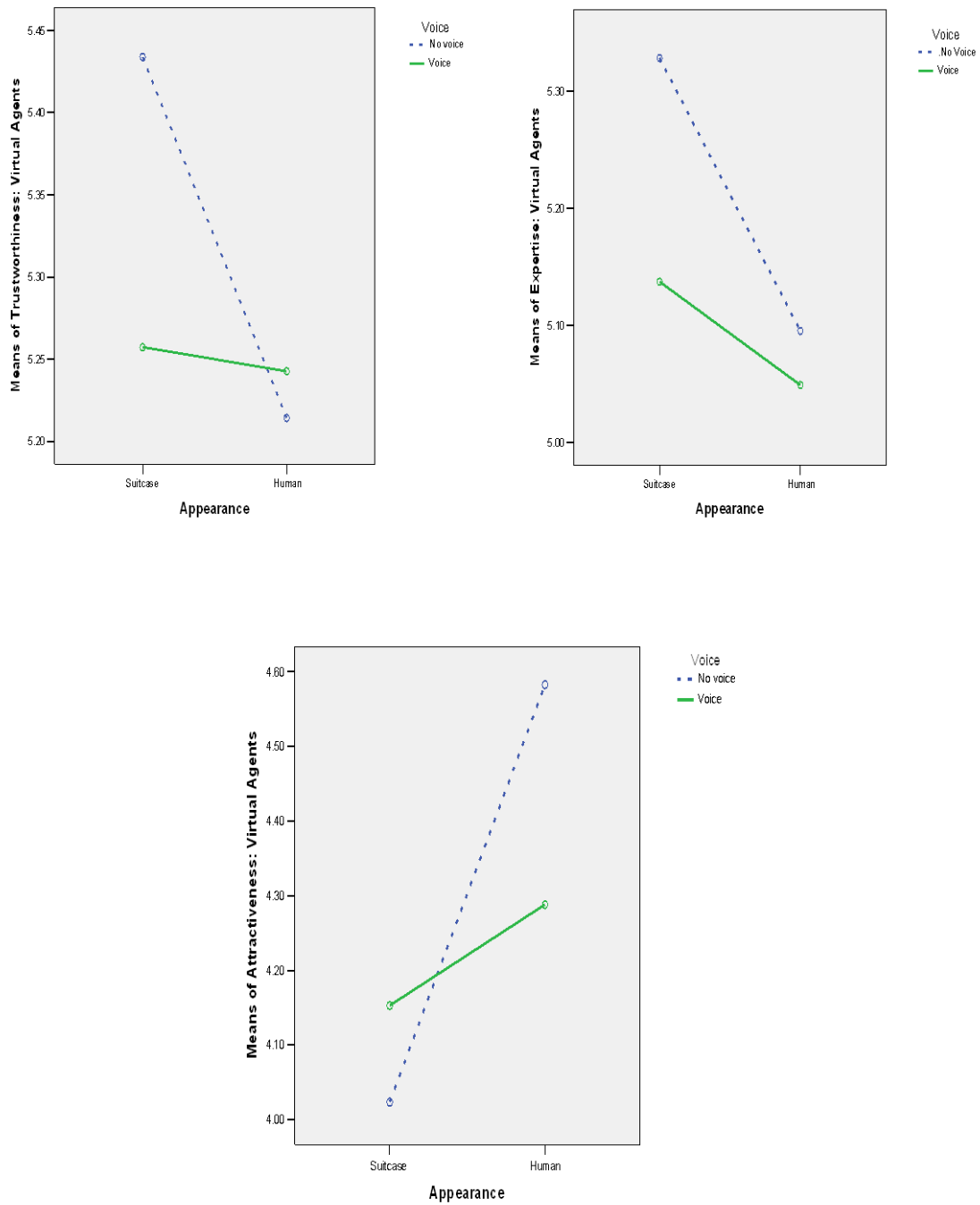
Effects of Anthropomorphism Cues on VA Evaluations

VA Evaluations (DVs)	Anthropomorphism Cues of VA	DF	F	P-Value
Perceived Expertise	Human-like appearance	1, 133	.600	.440
	Voice	1, 133	.327	.568
	Appearance*Voice	1, 133	.122	.727
Perceived Trustworthiness	Human-like appearance	1, 133	.365	.547
	Voice	1, 133	146	.703
	Appearance*Voice	1, 133	.279	.598
Perceived Attractiveness	Human-like appearance	1, 133	3.948	<b>.049</b>
	Voice	1, 133	.223	.637
	Appearance*Voice	1, 133	1.471	.227

Although only human appearance significantly influenced VA evaluations, the mean value plots show some interesting trends (see Figure 10). The suitcase condition achieved higher expertise and trustworthiness ratings, while the human condition achieved higher attractiveness ratings. This suggests that perceived attractiveness of virtual agents do not necessarily go hand in hand with perceived expertise and



trustworthiness of virtual agents. Indeed, the overall correlations of attractiveness with expertise and trustworthiness were only .422 ( $p < .001$ ) and .405 ( $p < .001$ ) respectively, which indicates medium strength of the relationships (Cohen, 1988). The correlations are even smaller for the human condition ( $r = .264$ ;  $p = .029$  for expertise,  $r = .260$ ;  $p = .031$  for trustworthiness). Also, the mean plots did not show a uniform trend for voice visible in that it had a negative effect, no effect or a positive effect depending on whether the VA has human appearance or not and the evaluation question asked. Specifically, system users' perceived expertise of VAs was higher for the suitcase VA without voice output rather than with voice output. In contrast, the perception of expertise was found to be slightly higher for the human VA with voice than without voice. In terms of users' perception of VA trustworthiness, system users evaluated VAs without voice as more trustworthy than VAs with voice output in both suitcase and human conditions. For the VA attractiveness evaluation, the results show that the perceived attractiveness of VAs is higher for the human without voice condition than the human with voice condition, but reverse trends are observed for the suitcase VAs. This shows that system users indicate higher attractiveness for the suitcase with voice output than without voice output. These trends suggest that the use of voice in RS contexts needs to be carefully designed and implemented since its impacts on RS user perceptions are not always positive.



**Figure 10.** Effects of Anthropomorphism Cues on VA Evaluations

If RS users do not distinguish between the VA and the system, direct effects of the anthropomorphism cues might be present. Voice output was found to be a significant influence on users' perceived liking of the system ( $F(1,133) = 4.36, P = .040$ ).

Descriptive results revealed that the group of users who received voice output liked the RS more ( $M = 5.83, SD = .91$ ) than the group of users who did not receive voice output ( $M = 5.51, SD = .88$ ). However, the actual difference in mean scores between the groups was very small and the effect size was also small (partial eta squared = .03) according to Cohen's guidelines (1988). The main effect for the human-like appearance of the VA and the interaction effects did not reach statistical significance (see Table 10).

**Table 10.**

Effects of Anthropomorphism Cues on RS Evaluations

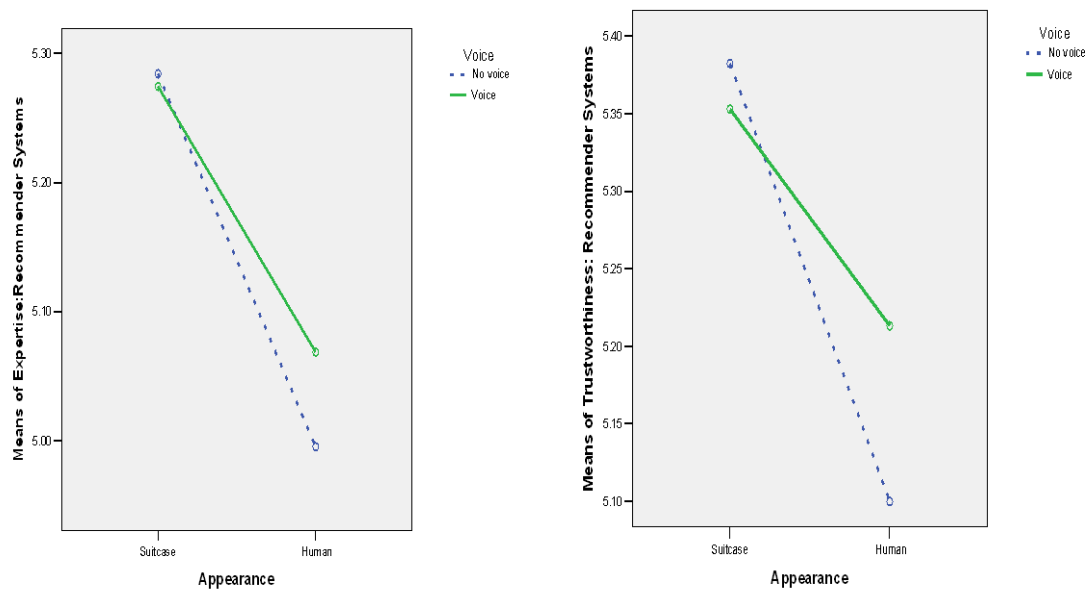
RS Evaluations (DVs)	Anthropomorphism Cues of VA	DF	F	P-Value
Perceived Expertise	Human-like appearance	1, 133	1.66	.200
	Voice	1, 133	.027	.869
	Appearance*Voice	1, 133	.047	.829
Perceived Trustworthiness	Human-like appearance	1, 133	1.269	.262
	Voice	1, 133	.050	.823
	Appearance*Voice	1, 133	.145	.704
Perceived Liking	Human-like appearance	1, 133	2.251	.136
	Voice	1, 133	4.319	<b>.040</b>
	Appearance*Voice	1, 133	.036	.849

Voice output positively affected overall system liking equally for the suitcase and the human conditions but only had a small, positive effects on system expertise and trustworthiness perceptions in the case of the human agents and further showed small negative effects on system expertise and trustworthiness perceptions for the suitcase agents (Figure 11). Although the effects were not significant, system expertise,

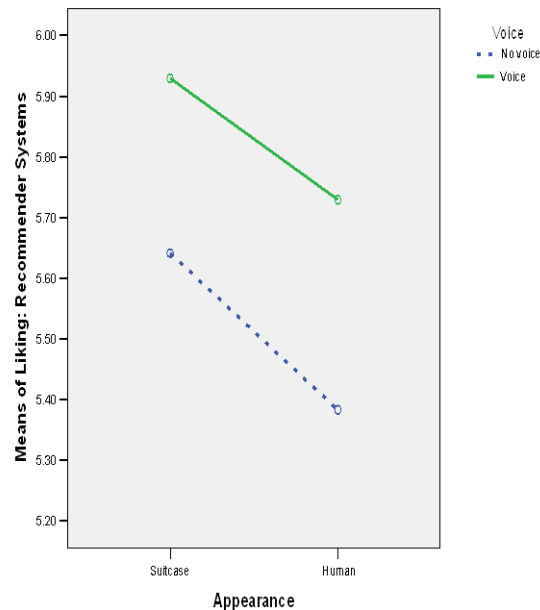
trustworthiness and liking perceptions were higher for the suitcase condition, which was unexpected. In order to further investigate these unexpected results, two post-studies were conducted. First, to better understand why RS expertise and trustworthiness perceptions were slightly higher in the case of the suitcase VA without voice than with voice, the perceived gender of the suitcase VA without voice was examined. While female voice output provided a female gender cue for the suitcase agent to system users, the perceived gender of the suitcase VA without voice was unknown. 27 undergraduate students were asked to indicate their perceived gender of the suitcase image. A great majority of participants (93%) perceived the suitcase VA as male while only one participant saw it as female and one as neutral. This suggests that users' perceived contradiction between what they saw and heard could play a potential role when users evaluate the VA and the system.

For the second post-study, the perceived enjoyment of the human and the suitcase conditions was examined since a number of previous studies have suggested influences of users' perceived enjoyment on their perceived usefulness of an RS (Koufaris & Hampton-Sosa, 2002; Qiu & Benbasat, 2009), trust in source (Koufaris & Hampton-Sosa, 2002), hedonic preference for agents (Gong, 2007) as well as behavioral intentions to use the RS (Koufaris, 2002). A total of 18 undergraduate students in a university in the United States participated in this study. They were asked to evaluate both human and suitcase VA images in terms of their perceived enjoyment. A 7-point semantic differential scale (Not enjoyable – Enjoyable) was used to measure the enjoyment perception.

Results showed that the perceived enjoyment of the suitcase VA was clearly higher ( $M = 4.89$ ,  $SD = 1.61$ ) than of the human VA ( $M = 3.56$ ,  $SD = 1.85$ ), which suggests that users' enjoyment of the VAs could be a potential explanation for the findings. In addition to their perceived enjoyment, participants were also asked to indicate whether the VA images were relevant to travel recommender systems using a 7-point semantic differential scale (Irrelevant – Relevant). Both human ( $M = 4.56$ ,  $SD = 1.62$ ) and suitcase ( $M = 4.78$ ,  $SD = 1.52$ ) conditions were evaluated as reasonably relevant to the travel RS context and the mean ratings for both conditions did not show any significant ( $p > .05$ ) differences.



**Figure 11.** Effects of Anthropomorphism Cues on RS Evaluations



**Figure 11. continued.**

### *The Relationships between VA Evaluations and RS Evaluations*

To investigate the relationships between interface VA evaluations and RS evaluations, multiple regression analyses were conducted. The regression models (Tables 11, 12 & 13) were statistically significant ( $p < .05$ ) and explained 62 percent, 58 percent and 46 percent of the variance of the users' perceptions of RSs respectively. The results revealed that system users' perceptions of VA expertise had significant influences on user's perceived expertise (beta = .692), trustworthiness (beta = .282) as well as liking (beta = .294) of the RS. Also, the perceived trustworthiness of the VA was found to have significant influences on perceived trustworthiness (beta = .502) and liking (beta = .418) of the RS. However, no significant relationships were found between the perceived attractiveness of the VA and the perceived expertise, trustworthiness and liking of the system. Thus, these findings only partially confirmed the hypothesized transfer effects.

**Table 11.**Influences of Perceptions of VA on Perceived *Expertise* of the RS

<b>Perceptions of VA =&gt; Perceived <i>expertise</i> of the RS</b>	<b>Beta</b>	<b>P-Value</b>
Perceived expertise of VA	.692	<b>.000</b>
Perceived trustworthiness of VA	.129	.262
Perceived attractiveness of VA	-.036	.538

R Square = 0.632; Adjusted R Square = 0.623; F (3, 133) = 75.98 (p&lt;.001)

**Table 12.**Influences of Perceptions of VA on Perceived *Trustworthiness* of the RS

<b>Perceptions of VA =&gt; Perceived <i>trustworthiness</i> of the RS</b>	<b>Beta</b>	<b>P-Value</b>
Perceived expertise of VA	.282	<b>.022</b>
Perceived trustworthiness of VA	.502	<b>.000</b>
Perceived attractiveness of VA	.013	.835

R Square = 0.592; Adjusted R Square = 0.582; F (3, 133) = 64.2 (p&lt;.001)

**Table 13.**Influences of Perceptions of VA on Perceived *Liking* of the RS

<b>Perceptions of VA =&gt; Perceived <i>liking</i> of the RS</b>	<b>Beta</b>	<b>P-Value</b>
Perceived expertise of VA	.294	<b>.036</b>
Perceived trustworthiness of VA	.418	<b>.003</b>
Perceived attractiveness of VA	-.012	.861

R Square = 0.472; Adjusted R Square = 0.460; F (3, 133) = 39.68 (p&lt;.001)

Since the model of this study indicates a mediating role of perceptions of the VA, a mediation model was tested using the causal steps outlined in the classic work of Baron and Kenny (1986) and Judd & Kenny (1981). According to Baron and Kenny (1986) a mediation model is required to have significant relations of 1) independent variable to the dependent variable, 2) independent variable to mediating variable and 3) mediating variable to the dependent variable. In this study, the examined relationships did not support these assumptions.

### *Influences of Participants' Gender*

To investigate the influence of recommender system users' gender on their evaluations of the VA, RS as well as the recommendation generated from the RS, a series of one-way ANOVA tests were conducted. The results (Table 14) showed that male and female system users were significantly different in terms of their perceptions of VA expertise ( $F(1, 135) = 6.51, p = .012$ ), trustworthiness ( $F(1, 135) = 10.11, p = .002$ ) as well as RS liking ( $F(1, 135) = 4.36, p = .039$ ). Although it did not reach statistical significance at the .05 level, differences of the two groups were observed in their perceptions of RS expertise ( $F(1, 135) = 3.01, p = .085$ ) and trustworthiness ( $F(1, 135) = 3.83, p = .052$ ) as well as the intentions to travel ( $F(1, 135) = 3.03, p = .084$ ) at the .10 level. However, no significant difference was found for system users' perceptions of VA attractiveness and their evaluations of the recommendation. Descriptive results showed that female system users evaluated the VA as well as the RS generally higher in terms of expertise, trustworthiness as well as liking but no difference was observed in their perceived attractiveness of VAs (See Table 15).

**Table 14.**

Effects of System Users' Gender on Users' Perceptions

<b>Independent Variable</b>	<b>Dependent Variables</b>	<b>DF</b>	<b>F</b>	<b>P</b>
Gender of System Users	Perceived expertise of VA	1, 135	6.509	<b>.012</b>
	Perceived trustworthiness of VA	1, 135	10.109	<b>.002</b>
	Perceived attractiveness of VA	1, 135	.004	.949
	Perceived expertise of RS	1, 135	3.014	.085
	Perceived trustworthiness of RS	1, 135	3.831	.052
	Perceived liking of RS	1, 135	4.363	<b>.039</b>
	Perceived fit with preference	1, 135	.764	.384
	Perceived attractiveness of destination	1, 135	.016	.899
	Intentions to travel	1, 135	3.028	.084



**Table 15.**

Mean Values of Male and Female Groups' VA and RS Evaluations

<b>Dependent Variables</b>	<b>Male</b>	<b>Female</b>
Perceived expertise of VA	4.77	5.32
Perceived trustworthiness of VA	4.85	5.49
Perceived attractiveness of VA	4.26	4.27
Perceived expertise of RS	4.91	5.27
Perceived trustworthiness of RS	4.99	5.38
Perceived liking of RS	5.43	5.78
Perceived fit with preference	5.45	5.66
Perceived attractiveness of destination	6.02	6.05
Intentions to travel	5.66	6.02

*Influences of RS Evaluations on Users' Attitudes toward the Recommendation*

To further examine whether RS evaluations matter in terms of attitudes and behavioral intentions toward the recommendation, a series of multiple regression analyses was employed. The results showed that users' perceptions of RS expertise positively influence users' perceived fit of the recommended destination with their preferences. In other words, RS users were more likely to think that the recommendation exactly fit their preferences when it came from an RS that was perceived as high in expertise (Table 16).

**Table 16.**

Influences of Perceptions of RS on Perceived Fit with Preference

<b>RS Evaluations =&gt; Perceived fit with Preference</b>	<b>Beta</b>	<b>P-Value</b>
Perceived expertise of RS	.405	<b>.004</b>
Perceived trustworthiness of RS	.127	.354
Perceived liking of RS	.151	.097

R Square = 0.396; Adjusted R Square = 0.383; F (3, 133) = 29.11(p&lt;.001)

It was also found that users' perceived trustworthiness and liking of the RS significantly influenced their perceived attractiveness of the recommended destination. Results showed that RS users' perceptions of destination attractiveness were higher when the destination recommendation was generated from a system that was perceived to be more trustworthy and likable (Table 17).

**Table 17.**

Influences of Perceptions of RS on Attractiveness of Destination

<b>RS Evaluations =&gt; Perceived Attractiveness of Destination</b>	<b>Beta</b>	<b>P-Value</b>
Perceived expertise of RS	.135	.358
Perceived trustworthiness of RS	.306	<b>.036</b>
Perceived liking of RS	.190	<b>.048</b>

R Square = 0.327; Adjusted R Square = 0.312; F (3, 133) = 21.53(p<.001)

As far as their behavioral intentions to travel to the recommended destination were concerned, no direct significant relations were found. However, both perceived fit and perceived attractiveness of the destination were found to have a significant positive impact on intentions to travel to the recommended destination (Tables 18 & 19).

**Table 18.**

Influences of Perceptions of RS on Intention to Travel to the Destination

<b>RS Evaluations =&gt; Intention to Travel</b>	<b>Beta</b>	<b>P-Value</b>
Perceived expertise of RS	.236	.117
Perceived trustworthiness of RS	.217	.142
Perceived liking of RS	.153	.116

R Square = 0.304; Adjusted R Square = 0.289; F (3, 133) = 19.39 (p<.001)

**Table 19.**

Influences of Recommendation Evaluations on Intention to Travel

<b>Recommendation Evaluations =&gt; Intention to Travel</b>	<b>Beta</b>	<b>P-Value</b>
Perceived fit with preference	.402	<b>.000</b>
Perceived attractiveness of the recommended destination	.350	<b>.000</b>

R Square = 0.489; Adjusted R Square = 0.482; F (2, 134) = 64.156 (p<.001)

## **Chapter Summary**

This chapter presented the first study of this dissertation. Study 1 investigated how VAs' anthropomorphic cues influenced system users' evaluations of VAs as well as RSs in terms of expertise, trustworthiness and attraction/liking. Findings partially supported the hypothesized relationships. The agents' human-like appearance was found to influence users' perceived attractiveness of the agent while voice output influenced system users' liking of the RS. In addition, it was found that users' perceptions of the VA significantly influenced overall RS evaluations, which suggests that transfer effects exist. This study further investigated how system users' RS evaluations influenced their perceptions toward the recommendation as well as behavioral intentions to travel to the recommended destination. Results showed that users' perceptions of RS expertise positively influenced users' perceived fit of the recommended destination with their preferences while the perceptions of RS trustworthiness and liking enhanced perceived attractiveness of the destination. No significant direct impacts of RS evaluations on users' behavioral intention to travel to the recommended destination were identified, but perceptions of destination attractiveness and perceived fit of the recommendation were found to influence behavioral intentions to travel to the recommended destination. Table 20 provides a summary of the results in terms of which hypotheses were supported, partially supported or not supported.

**Table 20.**

Summary of Support for Hypotheses of Study 1

<i>Relationship</i>		<i>Results</i>		
<b>The Effects of Human-Like Appearance on VA &amp; RS Evaluations</b>		S	NS	PS
<b>H<sub>1a</sub></b>	Users will perceive greater VA expertise when a human-like VA is presented rather than an object VA.		x	
<b>H<sub>1b</sub></b>	Users will perceive greater VA trustworthiness when a human-like VA is presented rather than an object VA.		x	
<b>H<sub>1c</sub></b>	Users will perceive greater VA attractiveness when a human-like VA is presented rather than an object VA.	x		
<b>H<sub>2a</sub></b>	Users will perceive greater RS expertise when a human-like VA is presented rather than an object VA.		x	
<b>H<sub>2b</sub></b>	Users will perceive greater RS trustworthiness when a human-like VA is presented rather than an object VA.		x	
<b>H<sub>2c</sub></b>	Users will perceive greater RS liking when a human-like VA is presented rather than an object VA.		x	
<b>The Effects of Voice Output on VA &amp; RS Evaluations</b>		S	NS	PS
<b>H<sub>3a</sub></b>	Users will perceive greater VA expertise when the VA provides voice output.		x	
<b>H<sub>3b</sub></b>	Users will perceive greater VA trustworthiness when the VA provides voice output.		x	
<b>H<sub>3c</sub></b>	Users will perceive greater VA attractiveness when the VA provides voice output.		x	
<b>H<sub>4a</sub></b>	Users will perceive greater RS expertise when the VA provides voice output.		x	
<b>H<sub>4b</sub></b>	Users will perceive greater RS trustworthiness when the VA provides voice output.		x	
<b>H<sub>4c</sub></b>	Users will perceive greater RS liking when the VA provides voice output.	x		
<b>The Effects of VA Evaluations on RS Evaluations</b>				
<b>H<sub>5</sub></b>	Perceived VA expertise positively influences perceived RS expertise, trustworthiness & liking.	x		
<b>H<sub>6</sub></b>	Perceived VA trustworthiness positively influences perceived RS expertise, trustworthiness & liking.			x
<b>H<sub>7</sub></b>	Perceived VA attractiveness positively influences perceived RS expertise, trustworthiness & liking.		x	

S=Supported; NS=Not Supported; PS=Partially Supported

## CHAPTER VI

STUDY 2-INFLUENCE OF SIMILARITY AND AUTHORITY CUES OF VIRTUAL  
AGENTS ON AGENT AND SYSTEM EVALUATIONS

### Conceptual Model and Hypotheses

Based on the literature reviewed and the conceptual framework developed in Chapter II, a conceptual model for Study 2 was developed (Figure 12). A total of fifteen hypotheses were derived from this model and were tested. To investigate the effects of similarity and authority of virtual agents' nonverbal cues, age and outfit of the virtual agent presented in the travel recommender systems were manipulated.

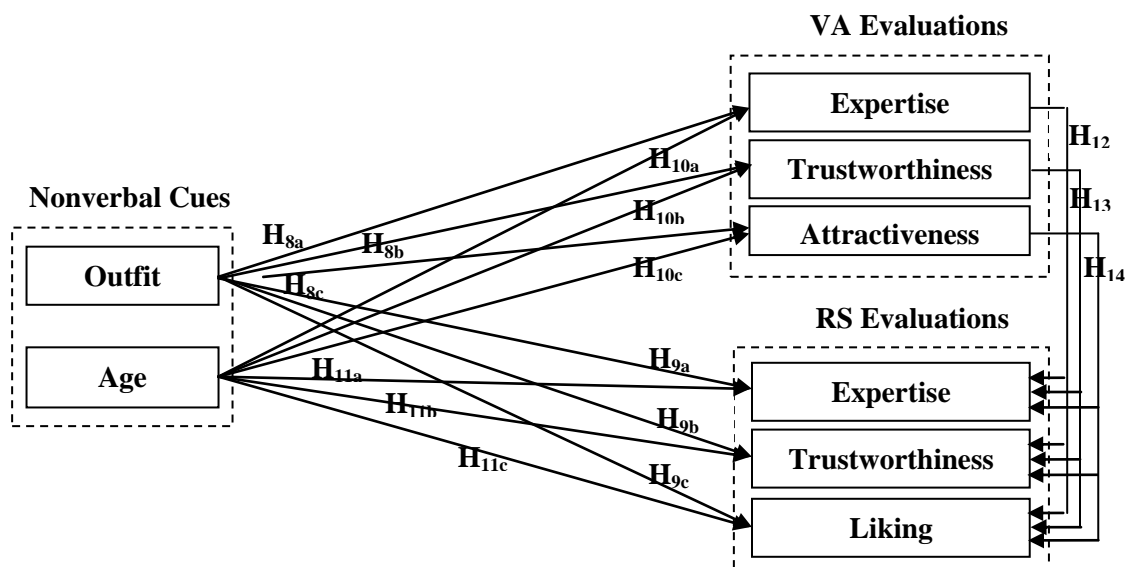


Figure 12. Study 2 Research Model

### *Effects of Outfit*

Burgoon and her colleagues (2002) discuss that the outfits of actors influence perceivers since outfits often communicate authority and similarity in interpersonal interactions. They pointed out that physical appearance can have a potent effect on the credibility of speakers, which in turn can have a substantial impact on compliance gaining. Uniforms have been considered as universally recognized potent cues that signify authority (Bickman, 1971; 1974; Burgoon et al., 1996; Burgoon et al., 2002; Joseph, 1986; Roads & Cialdini, 2002). It has been found that people are willing to comply with the requests of a person wearing a uniform (Bickman, 1971; 1974; Joseph, 1986) and that uniforms often bring mindless compliance (Road & Cialdini, 2002). In contrast, sources wearing informal casual outfits has been found to be viewed as less knowledgeable and intelligent but more friendly and fun than sources wearing formal outfits (Butler & Roesel, 1989; Davis, 1992; Workman et al., 1993). Based on these previous findings, the following hypotheses are posited.

***H<sub>8a</sub>***: Users will perceive greater VA expertise when the VA wears a uniform rather than a casual outfit.

***H<sub>8b</sub>***: Users will perceive greater VA trustworthiness when the VA wears a uniform rather than a casual outfit.

***H<sub>8c</sub>***: Users will perceive greater VA liking when the VA wears a casual outfit rather than a uniform.

***H<sub>9a</sub>***: Users will perceive greater RS expertise when the VA wears a uniform rather than a casual outfit.

***H<sub>9b</sub>***: Users will perceive greater RS trustworthiness when the VA wears a uniform rather than a casual outfit.

*H<sub>9c</sub>: Users will perceive greater RS liking when the VA wears a casual outfit rather than a uniform.*

### *Effects of Age*

The age of a message source has been found to be related to message receivers' perceptions in a number of studies (e.g. Ehrlich & Riesman, 1961; Leyva & Furth, 1986; McPeck & Gross, 1975; Piliavin, 1987; Yoo, Lee, & Gretzel, 2007). Specifically, it has been found that a similar age source is a preferred source (McPeck & Gross, 1975; Piliavin, 1987). McPeck and Gross (1975) investigated that college students more positively evaluated and preferred a speaker who was similar to them in age and appearance. Piliavin (1987) also examined if age similarity influenced voting preference. Results of these two studies reveal that the influences of age similarity on the development of perceived trustworthiness are complex. O'Keefe (2002) noted that similarity sometimes enhances perceived trustworthiness of a communicator, but sometimes it diminishes such perceptions. However, a number of studies have suggested that people who perceive similar attributes from a source of advice often build trust in the source and the message generated by the source (e.g., Creed & Miles, 1996; Giffin, 1967; Lau et al., 2008; McKnight et al., 1998).

An influence of older age has also been found in previous studies. Neugarten (1996) found that older age is identified as an authority position. Similarly, Ehrlich and Riesman (1961) reported that high school and college students perceive more authority from older counselors, and Yoo, Lee, and Gretzel (2007) found that authority derived

from older age increases perceived expertise when college students evaluate online travel reviewers.

In the context of virtual agents, no studies have investigated the effects of age. However, recent studies have indicated an influence of demographic similarity such as ethnicity and gender of virtual agents on users' perceptions (e.g. Baylor, 2005; Cowell & Stanney, 2005; Nass et al., 2000; Qiu, 2006). This suggests that demographic cues play a role when online users evaluate virtual agents as well as recommender systems. The following hypotheses were generated based on these previous findings:

***H<sub>10a</sub>**: A VA older in age than the user leads to greater perceptions of VA expertise than a VA similar in age*

***H<sub>10b</sub>**: A VA similar in age to the user leads to greater perceptions of VA trustworthiness than a VA older in age*

***H<sub>10c</sub>**: A VA similar in age to the user leads to greater perceptions of VA attractiveness than a VA older in age*

***H<sub>11a</sub>**: A VA older in age than the user leads to greater perceptions of RS expertise than a VA similar in age*

***H<sub>11b</sub>**: A VA similar in age to the user leads to greater perceptions of RS trustworthiness than a VA older in age*

***H<sub>11c</sub>**: A VA similar in age to the user leads to greater perceptions of RS liking than a VA older in age*

#### *Effects of Virtual Agents Evaluations on Recommender System Evaluation*

Same as in Study 1, transfer effects from the perceptions of virtual agents on overall system evaluations were assumed based on previous findings (Goldsmith et al.,



2000; Lafferty & Goldsmith, 1999; Qiu & Benbasat, 2009) and the following hypotheses were proposed.

*H<sub>12</sub>: Perceived VA expertise positively influences perceived RS expertise, trustworthiness & liking.*

*H<sub>13</sub>: Perceived VA trustworthiness positively influences perceived RS expertise, trustworthiness & liking*

*H<sub>14</sub>: Perceived VA attractiveness positively influences perceived RS expertise, trustworthiness & liking*

### **Study Design**

The second experiment only involved human virtual agents. Two factors were manipulated with two levels per factor, thus leading to a 2 x 2 full-factorial between-subjects design. The first factor was virtual agent outfit and the second factor was virtual agent age.

*Outfit.* For the high authority/dissimilar condition, a virtual agent wearing a uniform was presented in the recommender system interface, as uniforms have been considered as a universally recognized symbol of authority that can bring mindless compliance (DeGorge, 1985; Rhoads & Cialdini, 2002). Conversely, a virtual agent wearing a casual outfit was presented for the low authority/similar condition.

*Age.* Age was manipulated by including young versus old-looking virtual agents. Since the subjects of this proposed study were a homogeneously young age group, the young virtual agent represented the similar/low authority condition while the old virtual agent

constituted the dissimilar/high authority condition. For the old virtual agent condition, the virtual agent was designed to be around age 35, since a previous study conducted in the online travel review context (Yoo, Lee, & Gretzel, 2007) found that age 35 was perceived as clearly older by undergraduate subjects but not so old so that they would discredit the advice provided from the source as irrelevant. The virtual agents' age was manipulated using Adobe Photoshop 7.0. To make the young agents look older, hair color was changed by adding gray color to the hair, wrinkles were drawn around the eyes, lips, forehead and neck, the areas under the eyes were shaded to make dark circles, and age spots were added to face, neck and arms. The manipulated VAs were pre-tested with 16 undergraduate students to make sure that perceived ages between young VAs versus old VAs were different. The pre-test results showed that there was a significant difference in terms of participants' perceived age between old VA and young VA conditions ( $F(1, 14) = 15.34, p = .002$ ). The descriptive results indicated that the young VAs were on average perceived as either 25 (casual outfit,  $SD = 1.26$ ) or 27 (uniform,  $SD = 3.83$ ) while the old VAs were perceived as on average 37 (casual outfit,  $SD = 10.12$ ) or 39 (uniform,  $SD = 1$ ).

The four experimental conditions used in Study 2 are presented in Figure 13.



**Figure 13.** The Four Virtual Agents Used in Study 2

Age and outfit manipulations were checked with two 7 point Likert-type scales that asked the participants to indicate their opinions of the agents' age and to describe their usual clothing style. Also, the participants were asked to indicate their overall perceptions of similarity of the VAs with themselves.

### **Participants**

Data was collected from November 18, 2008 to February 5, 2008. A total of 231 undergraduate students in a University in the United States participated in the experiment. Course extra-credit was used as an incentive.

### **Procedures**

Study 2 followed the same experimental procedures employed for Study 1. When participants arrived at the research lab, they were greeted, seated in front of a computer, and informed that a travel agency was interested in embedding a newly developed RS on

its website and would like them to evaluate the system. Then, a hypothetical situation which asked them to search for a destination for a spring break vacation was explained to the subjects. Participants were randomly assigned to one of the experimental conditions, showing the homepage of a travel RS. Participants in all conditions were asked to answer the same 10 questions aimed at capturing their vacation preferences which were adapted and modified from Gretzel (2004) as well as the vacation personality quiz developed by the United States Tour Operators Association (USTOA) (See Appendix C).

After answering all the questions, participants were presented with the name, picture and description of a spring break vacation destination (See Appendix D). The destination was chosen based on the findings of a pilot study that aimed to identify an appropriate destination. Similar to Study 1, every participant received the same recommendation so that the variations in the evaluation of the RS would depend on the experimental conditions, not the specific characteristics of the recommended destination. The preference elicitation questions were designed so that independent of the answer to the questions, the destination would appear as a suitable solution. Study participants were then asked to evaluate the system and the VA in terms of expertise, trustworthiness and liking/attractiveness. Questions regarding participants' prior visiting experience of the recommended destination, their perceptions of the destination attractiveness and intentions to travel to the place were also included. In addition, their perceived fit of the recommendation with their preference, prior travel RS use experience, Internet skills, the extent of travel experience and demographic information were also asked (Appendix E).

## Measures

Participants' evaluations of VAs and RSs were measured with the same measurement items that were developed and tested in Study 1. A confirmatory factor analysis was employed to examine the reliability and validity of the scales. Results showed that all items loaded on the corresponding factors and were statistically significant ( $p < .001$ ). A marginally acceptable model fit was found:  $\chi^2(87) = 256.573$  ( $p < .001$ ), CFI = .934, TLI = .920 and RMSEA = .092. Since the correlation (.86) between trustworthiness and expertise exceeded the cut-off level of .85 (Brown, 2006), the model was respecified by collapsing expertise and trustworthiness to assess the model fit (Brown, 2006). Overall model fit of the modified model was:  $\chi^2(90) = 307.130$  ( $p < .001$ ), CFI = .916, TLI = .902 and RMSEA = .102. Similar to the findings of Study 1, the model fit was found to be better when perceived credibility was measured with two factors of expertise and trustworthiness, thus Study 2 also measured credibility using the two dimensions. The factor loadings of the items and scale reliability coefficients are presented in Table 21. All items highly loaded on corresponding factors and the reliability coefficients for all scales exceeded .8 indicating good reliabilities of scales.

Consistent with Study 1, subjects were also asked to evaluate VAs in terms of expertise, trustworthiness and attractiveness. All items highly loaded onto corresponding factors and the alpha coefficients were at or above 0.9, which indicated good reliability of the scales (expertise = .97, trustworthiness = .93 and attractiveness = .90) (Table 22). Overall model fit was marginally acceptable:  $\chi^2(87) = 258.395$  ( $p < .001$ ), CFI = .955, TLI = .945 and RMSEA = .093.

**Table 21.**

Factor Loadings &amp; Construct Reliability for RS Evaluation Measurement

RS Evaluation Construct Names & Items	Mean	SD	Factor Loadings	Construct Reliability
<b>Perceived Expertise</b>	<b>5.36</b>	<b>1.01</b>		<b>.93</b>
Unknowledgeable – Knowledgeable	5.48	1.18	.85	
Unintelligent – Intelligent	5.33	1.19	.84	
Incompetent - Competent	5.55	1.14	.85	
Uninformed – Informed	5.51	1.21	.83	
Unskilled - Skilled	5.29	1.16	.82	
Inexpert - Expert	5.03	1.13	.79	
<b>Perceived Trustworthiness</b>	<b>5.38</b>	<b>0.99</b>		<b>.88</b>
Unreliable – Reliable	5.31	1.22	.87	
Undependable – Dependable	5.21	1.13	.83	
Untrustworthy – Trustworthy	5.32	1.11	.78	
Dishonest - Honest	5.68	1.16	.72	
<b>Perceived Liking</b>	<b>5.74</b>	<b>0.88</b>		<b>.85</b>
Not nice – Nice	6.19	0.95	.86	
Unpleasant – Pleasant	6.20	0.94	.84	
Unfriendly – Friendly	5.94	1.02	.80	
Dislikable – Likable	5.94	1.02	.77	
Plain - Elegant	4.22	1.52	.55	

**Table 22.**

Factor Loadings &amp; Construct Reliability for VA Evaluation Measurement

VA Evaluation Construct Names & Items	Mean	SD	Factor Loadings	Construct Reliability
<b>Perceived Expertise</b>	<b>5.22</b>	<b>1.22</b>		<b>.97</b>
Unintelligent – Intelligent	5.23	1.32	.93	
Unknowledgeable – Knowledgeable	5.32	1.33	.93	
Uninformed – Informed	5.30	1.35	.92	
Unskilled - Skilled	5.18	1.29	.92	
Incompetent - Competent	5.33	1.29	.92	
Inexpert - Expert	4.94	1.28	.89	
<b>Perceived Trustworthiness</b>	<b>5.25</b>	<b>1.13</b>		<b>.93</b>
Undependable – Dependable	5.22	1.28	.91	
Unreliable – Reliable	5.10	1.26	.88	
Untrustworthy – Trustworthy	5.11	1.25	.87	
Dishonest - Honest	5.55	1.19	.83	
<b>Perceived Attractiveness</b>	<b>3.77</b>	<b>1.30</b>		<b>.90</b>
Unattractive – Attractive	3.98	1.52	.91	
Ugly – Beautiful	4.16	1.34	.91	
Plain – Elegant	3.32	1.73	.77	
Not sexy – Sexy	2.84	1.47	.73	
Not classy - Classy	4.54	1.58	.72	

In addition, the Study 2 survey also included questions regarding the system users' intentions to travel, their perceived fit of the recommended destination with their preferences, as well as their perceived attractiveness of the destination. Tables 23 and 24 display the measurements of RS users' intentions to travel to the recommended destination as well as their perceived fit of the recommendation with their preferences achieved good reliabilities. Like in Study 1, RS users' perceived attractiveness of the destination was measured with a single question that asked how attractive the recommended destination is with responses ranging from 1 (Not at all attractive) to 7 (Extremely attractive).

**Table 23.**

Scales for Intention to Travel to Recommended Destination

<b>Items of Intention To Travel to Recommended Destination</b>	<b>Mean</b>	<b>SD</b>	<b>Factor Loadings</b>	<b>Eigen Value</b>	<b>% of Var.</b>	<b><math>\alpha</math></b>
If you won a free Spring Break vacation, and one of the places you could go on that vacation was the one suggested by the recommender system, how would you respond to the following questions?	<b>5.98</b>	<b>1.05</b>		<b>2.60</b>	<b>86.5</b>	<b>.92</b>
The probability that I would consider the recommended destination for the trip is very high	5.97	1.16	.95			
The likelihood that I would travel to the recommended destination is very high	5.79	1.27	.94			
I would be willing to accept the recommendation suggested by this recommender system	6.16	0.93	.91			

**Table 24.**

Scales for System Users' Perceived Fit of Recommendation

<b>Items of Users' Perceived Fit of Recommendation</b>	<b>Mean</b>	<b>SD</b>	<b>Factor Loadings</b>	<b>Eigen Value</b>	<b>% of Var.</b>	<b><math>\alpha</math></b>
	<b>5.69</b>	<b>1.12</b>		<b>2.61</b>	<b>86.9</b>	<b>.92</b>
The recommended destination suits my needs.	5.76	1.22	.95			
The recommended destination reflects what I like to experience when going on vacation	5.78	1.22	.94			
The recommended destination is exactly what I want	5.53	1.15	.91			

## **Analysis**

Age and outfit manipulations were checked with a one-way ANOVA and descriptive analyses. Participants profile and overall evaluations of VAs, RSs and of the recommendation were described using descriptive analyses. To investigate the effects of specific characteristics of the VA, a series of two-way between-subjects analysis of variance (ANOVA) tests was used. Gender effects were examined with a series of one-way ANOVAs. Further, multiple regression analyses were employed to assess the influence of the perceptions of VAs on RS evaluations as well as to examine the relationships between RS evaluations and participants' intention to travel to the recommended destination, perceived fit of the recommendation and perceived attractiveness of the recommended destination.

## **Results**

### *Manipulation Checks*

Age manipulation was checked with a two-way between-groups ANOVA. The results (Table 25) showed that there is a significant main effect for VA's age manipulation ( $F(1, 224) = 150.10, p < .001$ ) with a large effect size (partial eta squared = .40) (Cohen, 1988). As intended old-looking VAs were perceived as significantly older ( $M = 37.34, SD = 9.96$ ) than young-looking VAs ( $M = 24.86, SD = 5.49$ ) thus suggesting the age manipulation was successful. In addition, a significant main effect of VA's outfit was also found ( $F(1, 224) = 18.08, p < .001$ ). The effect size was moderate with a partial eta squared of .08 (Cohen, 1988). The VAs with uniform outfits were perceived older ( $M$



= 33.21, SD = 9.26) than the VAs with casual outfits (M = 29.07, SD = 10.58). No significant interaction effect was found.

**Table 25.**

Effects of Age and Outfit Cues of VA on RS users' Perceived Age of VA

<b>Perceived Age</b>	<b>Nonverbal Cues of VA</b>	<b>DF</b>	<b>F</b>	<b>P-Value</b>
Perceived age of VA	Age	1, 224	150.102	.000
	Outfit	1, 224	18.078.	.000
	Age*Outfit	1, 224	.092	.762

Outfit manipulation was checked with a question that asked study participants to describe their usual clothing style. This question was used to check whether the casual outfit was the similar outfit condition. Results showed that 96 percent of participants said their outfit was very or somewhat casual while no one said their usual outfit was formal. These results indicate that the outfit manipulation was appropriate.

Users' perceived similarity with a virtual agent was checked with a one-way ANOVA. Only the young and casual outfit condition is similar to the participants of this study while the other conditions (young uniform, old casual and old uniform) display at least one dissimilar cue in terms of age and outfit. The similar condition was compared with the dissimilar conditions. ANOVA results found no significant differences ( $F(1, 229) = .603, p = .438$ ) but the mean trends showed that a similar VA in terms of age and outfit was perceived more similar (M = 3.71, SD = 1.71) than dissimilar VAs (M = 3.53, SD = 1.44), thus suggesting that our manipulation was appropriate. However, the mean difference was quiet small. Previous studies suggest that individuals use many heuristic cues (Burgooon et al., 2002) when they evaluate similarity and gender has been

identified as one of the important cues (Ensher & Murphy, 1997; Turban, Dougherty, & Lee, 2002). To further examine participants' similarity perception, a one-way ANOVA was performed with split data in terms of gender. Still no significant differences were found for both female and male groups in terms of their perceived similarity between a similar VA and dissimilar VAs. However, the mean trend results suggested a clear difference between the two groups. While female participants showed higher similarity perceptions with the similar condition ( $M_{\text{similar}} = 3.8$  vs.  $M_{\text{dissimilar}} = 3.5$ ), male participants were found to perceive similarity from authority cues such as older age or uniform outfits ( $M_{\text{similar}} = 3.5$  vs.  $M_{\text{dissimilar}} = 3.7$ ). These findings suggest that authority cues expressed through age and outfit were successfully manipulated but that the male participants in the study actually identified with the authority conditions rather than the similarity conditions.

### *Sample Profile*

The Study 2 participants' profile was very similar to Study 1. More females (83%) than males participated in the study and most of them were between 21 and 23 years old (87%) and Caucasian (77%). A great majority of participants reported that they had never used a travel RS before (97%), but had good internet knowledge and skills (97%). In terms of their travel experience, 75 percent said they had travel experience within the United States while 28 percent reported to have international travel experience.

### *Descriptive Results*

The evaluations of the presented interface VAs were reasonably high in terms of participants' perceived expertise ( $M = 5.22$ ,  $SD = 1.22$ ) and trustworthiness ( $M = 5.25$ ,  $SD = 1.13$ ), but were only moderate for perceived attractiveness ( $M = 3.77$ ,  $SD = 1.30$ ). Regarding RS evaluations, participants' perceptions of RS expertise ( $M = 5.36$ ,  $SD = 1.01$ ), trustworthiness ( $M = 5.38$ ,  $SD = .99$ ) and liking ( $M = 5.74$ ,  $SD = .88$ ) were found to be reasonably high, which suggests that the experimental manipulations looked realistic and appropriate. In terms of participants' prior visiting experience of the recommended destination, most of them (92%) reported that they had not visited the destination, but they perceived the recommended destination to be very attractive ( $M = 6.37$ ,  $SD = 1.03$ ) and a reasonable fit with their preferences ( $M = 5.69$ ,  $SD = 1.12$ ). Their intention to travel to the recommended destination was also high ( $M = 5.98$ ,  $SD = 1.05$ ).

### *Influences of Nonverbal Similarity and Authority Cues*

To investigate the influences of nonverbal cues of VAs on their overall system evaluations, a series of two-way between-group ANOVAs were conducted. The results (Table 26) revealed that there was a statistically significant main effect for VA's outfit on users' perceptions of VA expertise ( $F(1, 227) = 3.88$ ,  $P = .050$ ). The perceived expertise of VAs was higher when the VA wore a uniform ( $M = 5.38$ ,  $SD = 1.06$ ) rather than a casual outfit ( $M = 5.06$ ,  $SD = 1.34$ ); thus,  $H_{8a}$  was supported. However, the actual mean difference between the groups was very small as was the effect size (partial eta squared = .02) (Cohen, 1988). Results also indicated that the influence of VAs' age on

system users' perceptions of VA attractiveness was marginally significant ( $F(1, 227) = 3.71, P = .055$ ). System users evaluated the similar aged VAs ( $M = 3.93, SD = 1.23$ ) as more attractive than the older VAs ( $M = 3.61, SD = 1.34$ ); thus,  $H_{10c}$  was marginally supported. No other significant main effects or interaction effects were found.

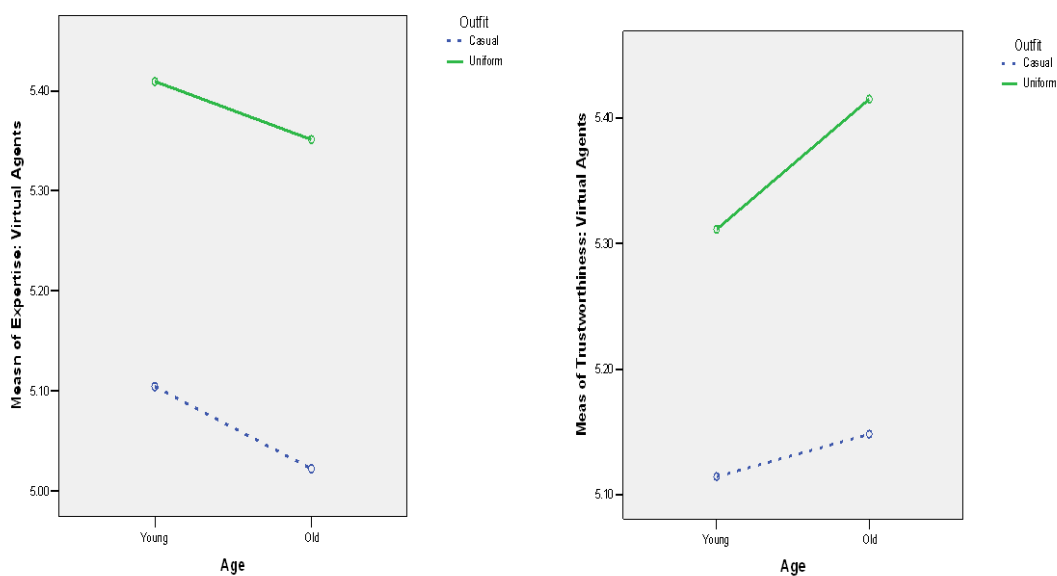
**Table 26.**

Effects of Nonverbal Cues on VA Evaluations

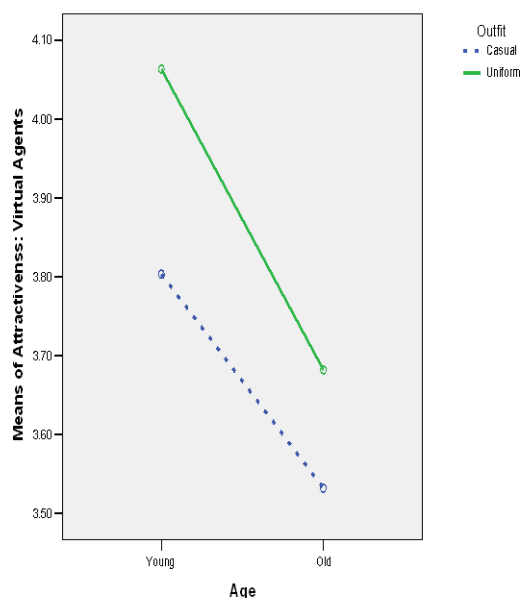
VA Evaluations (DVs)	Nonverbal Cues of VA	DF	F	P-Value
Perceived Expertise	Outfit	1, 227	3.897	<b>.050</b>
	Age	1, 227	.191	.663
	Outfit*Age	1, 227	.005	.941
Perceived Trustworthiness	Outfit	1, 227	2.436	.120
	Age	1, 227	.215	.644
	Outfit*Age	1, 227	.055	.814
Perceived Attractiveness	Outfit	1, 227	1.464	.228
	Age	1, 227	3.710	.055
	Outfit*Age	1, 227	.105	.746

Although the ANOVA findings revealed only a significant main effect of VAs' outfit on system users' perceptions of VA expertise and a marginal influence of age on users' perceived attractiveness of the VA, some interesting trends were observed in the mean value plots (see Figure 14). The perceived expertise of VAs was clearly higher when the VAs wore uniforms rather than casual outfits. However, the perceptions of VA expertise were consistently higher for the similar aged VAs than the older VAs in both uniform and casual outfit conditions, which indicated that age similarity rather than age authority enhanced the perceptions of VA expertise in a travel destination recommendation context. The mean plot of the perceived trustworthiness of VAs also showed somewhat unexpected trends related to VA age cues. System users evaluated the

older VA as more trustworthy than the similar aged VA; however, the difference was very small. As discussed earlier, it has been noted that similarity sometimes enhances perceived trustworthiness of a communicator, but sometimes it diminishes such perceptions (O'Keefe, 2002). In this study, age authority rather than similarity positively influenced VA trustworthiness. In terms of VA attractiveness, the perceptions of VA attractiveness was higher for the similar aged VAs than the older VAs as expected, but VAs with uniforms rather than casual outfits were evaluated as more attractive.



**Figure 14.** Effects of Nonverbal Cues on VA Evaluations



**Figure 14. continued.**

The direct effects of the VA's nonverbal cues on system users' evaluations of the overall RS were examined with a series of ANOVAs, but no significant main effects as well as interaction effects were found. (see Table 27).

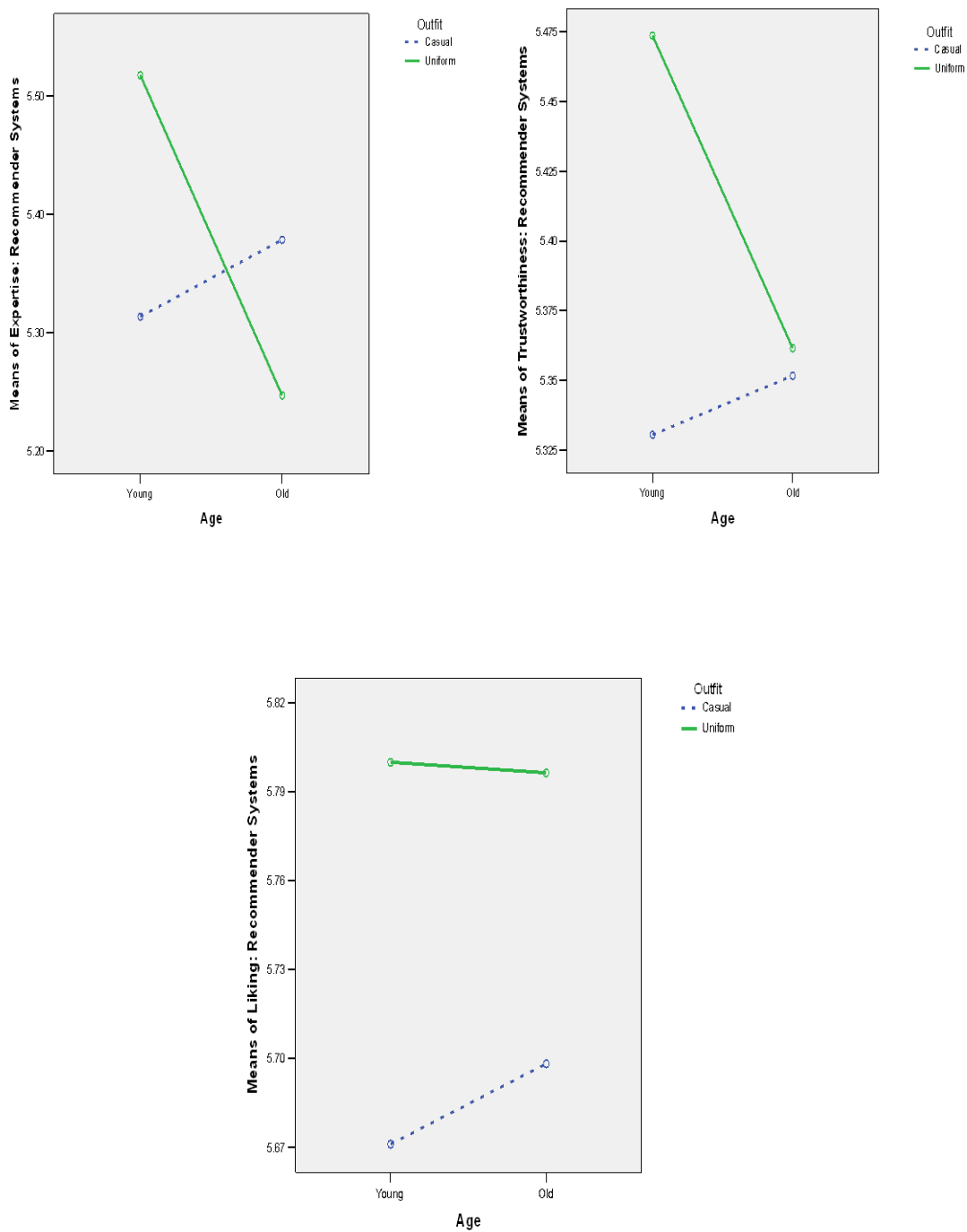
**Table 27.**

Effects of Nonverbal Cues on RS Evaluations

RS Evaluations (DVs)	Nonverbal Cues of VA	DF	F	P-Value
Perceived Expertise	Outfit	1, 227	.075	.785
	Age	1, 227	.602	.439
	Outfit*Age	1, 227	1.603	.207
Perceived Trustworthiness	Outfit	1, 227	.345	.558
	Age	1, 227	.121	.728
	Outfit*Age	1, 227	.261	.610
Perceived Liking	Outfit	1, 227	.959	.329
	Age	1, 227	.010	.919
	Outfit*Age	1, 227	.018	.895

The trends observed by the mean plots (Figure 15) indicated that the perceptions of RS expertise, trustworthiness and liking were consistently higher for the similar aged VAs with uniforms, but rather lower when VAs wore casual outfits. In other words, the RS was evaluated as having more expertise, being more trustworthy and being more likable when its interface presented a similar aged VA with a uniform rather than a similar aged VA with a casual outfit.

Interestingly, the perceived expertise of the RS was higher for the older VA with a casual outfit rather than for the older VA with a uniform, which was unexpected. In contrast to the hypotheses, system trustworthiness and liking perceptions were higher for the uniform condition in both similar aged and older VA conditions. Although these trends did not provide a clear answer to how the age and outfit of VAs influenced RS users' evaluations of systems, an interesting trend was observed. Overall, the mean plots showed that the participants' perceptions of RS expertise, trustworthiness and liking achieved the highest scores when young VAs with uniforms were displayed. A possible explanation could be that young women are used as typical visual cues in tourism promotional materials (Heatwole, 1989; Sirakaya & Sonmez, 2000; Swaine, 1995) and also that uniforms or formal outfits are perceived as more appropriate in an advice-giving agent role (Joseph, 1986).



**Figure 15.** Effects of Nonverbal Cues on RS Evaluations



*The relationships between VA evaluations and RS evaluations*

Multiple regression analyses were employed to examine the relationships between interface VA evaluations and the overall RS evaluations. All regression models (Table 28, 29 & 30) were statistically significant and explained 48 percent, 47 percent and 51 percent of the variance of the users' perceptions of RSs respectively. The results indicated system users' perceptions of VA expertise had significant influences on user's perceived expertise (beta = .584) and liking (beta = .630) of the RS. Also, perceived trustworthiness of the VA was found to have significant influences on perceived trustworthiness (beta = .568) of the RS. However, no significant relationships were found between the perceived attractiveness of the VA and the perceived expertise, trustworthiness and liking of the RS. These findings are similar to the results of Study 1 and again partially confirmed the hypothesized transfer effects.

**Table 28.**

Influences of Perceptions of VA on Perceived *Expertise* of the RS

<b>Perceptions of VA =&gt; Perceived <i>expertise</i> of the RS</b>	<b>Beta</b>	<b>P-Value</b>
Perceived expertise of VA	.584	<b>.000</b>
Perceived trustworthiness of VA	.145	.174
Perceived attractiveness of VA	-.045	.409

R Square = 0.485; Adjusted R Square = 0.478; F (3, 227) = 71.23 (p<.001)

**Table 29.**

Influences of Perceptions of VA on Perceived *Trustworthiness* of the RS

<b>Perceptions of VA =&gt; Perceived <i>trustworthiness</i> of the RS</b>	<b>Beta</b>	<b>P-Value</b>
Perceived expertise of VA	.178	.093
Perceived trustworthiness of VA	.568	<b>.000</b>
Perceived attractiveness of VA	-.094	.086

R Square = 0.478; Adjusted R Square = 0.471; F (3, 227) = 69.4 (p<.001)

**Table 30.**Influences of Perceptions of VA on Perceived *Liking* of the RS

<b>Perceptions of VA =&gt; Perceived <i>liking</i> of the RS</b>	<b>Beta</b>	<b>P-Value</b>
Perceived expertise of VA	<b>.630</b>	<b>.000</b>
Perceived trustworthiness of VA	.047	.647
Perceived attractiveness of VA	.094	.075

R Square = 0.518; Adjusted R Square = 0.512; F (3, 227) = 81.41 (p&lt;.001)

*Influences of Participants' Gender*

To investigate the influence of recommender system users' gender on their evaluations of the VA, RS as well as the recommendation generated by the system, a series of one-way ANOVA tests were conducted. As displayed in Table 31, the results showed that RS users' gender significantly influenced perceptions of RS trustworthiness ( $F(1, 229) = 3.9, p = .05$ ). There were also moderately significant relationships between RS users' gender and the perceptions of RS expertise as well as liking. Descriptive results showed that female system users evaluated the RSs higher in terms of expertise, trustworthiness as well as liking (See Table 32). These results were consistent with Study 1 and again confirmed possible gender effects on system users' evaluation of RSs.

**Table 31.**

Effects of System Users' Gender on Users' Perceptions

<b>Independent Variable</b>	<b>Dependent Variables</b>	<b>DF</b>	<b>F</b>	<b>P</b>
Gender of System Users	Perceived expertise of VA	1, 229	1.026	.312
	Perceived trustworthiness of VA	1, 229	.130	.719
	Perceived attractiveness of VA	1, 229	.167	.683
	Perceived expertise of RS	1, 229	3.372	.068
	Perceived trustworthiness of RS	1, 229	3.895	<b>.050</b>
	Perceived liking of RS	1, 229	3.008	.084
	Perceived fit with preference	1, 229	2.134	.145
	Perceived attractiveness of destination	1, 229	.039	.844
	Intentions to travel	1, 229	1.202	.274

**Table 32.**

Mean Values of Male and Female Groups' VA and RS Evaluations

<b>Dependent Variables</b>	<b>Male</b>	<b>Female</b>
Perceived expertise of VA	5.01	5.25
Perceived trustworthiness of VA	5.18	5.26
Perceived attractiveness of VA	3.85	3.75
Perceived expertise of RS	5.09	5.42
Perceived trustworthiness of RS	5.09	5.44
Perceived liking of RS	5.52	5.78
Perceived fit with preference	5.45	5.74
Perceived attractiveness of destination	6.34	6.38
Intentions to travel	5.81	6.01

*Influences of RS Evaluations on Users' Attitudes toward Recommendation*

The relationships between RS evaluations and system users' attitudes and behavioral intentions toward the recommendation were also investigated in Study 2 using a series of multiple regression analyses. Results showed that users' perceptions of RS trustworthiness positively influenced users' perceived fit of the recommended destination with their preferences. This means RS users were more likely to think that the recommendation exactly fit their preferences when it was suggested by an RS that was perceived as trustworthy (Table 33). Results also indicated that users' perceived attractiveness of the recommended destination was enhanced when the recommendation came from a likable RS (Table 34).

**Table 33.**

Influences of Perceptions of RS on Perceived fit of Recommendation

<b>RS Evaluations =&gt; Perceived fit of Recommendation</b>	<b>Beta</b>	<b>P-Value</b>
Perceived expertise of RS	.171	.123
Perceived trustworthiness of RS	.306	<b>.003</b>
Perceived liking of RS	.070	.335

R Square = 0.251; Adjusted R Square = 0.241; F (3, 227) = 25.37(p&lt;.001)

**Table 34.**

Influences of Perceptions of RS on Attractiveness of Destination

<b>RS Evaluations =&gt; Perceived Attractiveness of Destination</b>	<b>Beta</b>	<b>P-Value</b>
Perceived expertise of RS	.033	.778
Perceived trustworthiness of RS	.171	.124
Perceived liking of RS	.225	<b>.004</b>

R Square = 0.139; Adjusted R Square = 0.127; F (3, 227) = 12.20(p&lt;.001)

As far as the users' behavioral intentions to travel to the recommended destination were concerned, the perception of RS trustworthiness was found to play a significant role in increasing users' likelihood to travel to the destination, but no significant effects were found in terms of users' perceptions of RS expertise and liking (Table 35). Further, the results showed that both perceived fit and perceived attractiveness of the recommended destination had a significant positive impact on intentions to travel to the recommended destination (Table 36).

These results suggest a mediating role of users' perceived fit. The four steps of Baron and Kenny (1986) confirmed the mediating role of perceived fit between RS trustworthiness and intention to travel. To estimate an indirect coefficient, two regression analyses were performed as suggested by Judd & Kenny (1981). First, a regression model that investigated the impacts of both RS trustworthiness and perceived fit as independent variables on users' intentions to travel was performed. The regression model was significant ( $F(2, 228) = 73.341, p < .001$ ) and explained 39 percent of the variance of RS users' intentions to travel to the recommended destination. Second, a regression model with only RS trustworthiness as the independent variable was employed. The regression coefficient (Beta = .302) for RS trustworthiness derived from the first model

was subtracted from the obtained coefficient of the second regression model (Beta = .506). The estimated indirect coefficient was .204, which suggests that system users' perceived fit of the recommendation partially mediates the relation between perceived RS trustworthiness and travel intentions.

**Table 35.**

Influences of Perceptions of RS on Intention to Travel to the Destination

<b>RS Evaluations =&gt; Intention to Travel</b>	<b>Beta</b>	<b>P-Value</b>
Perceived expertise of RS	-.118	.283
Perceived trustworthiness of RS	.547	<b>.000</b>
Perceived liking of RS	.110	.124

R Square = 0.264; Adjusted R Square = 0.255; F (3, 227) = 27.19 (p<.001)

**Table 36.**

Influences of Recommendation Evaluations on Intention to Travel

<b>Recommendation Evaluations =&gt; Intention to Travel</b>	<b>Beta</b>	<b>P-Value</b>
Perceived fit of recommendation	.430	<b>.000</b>
Perceived attractiveness of the recommended destination	.222	<b>.001</b>

R Square = 0.352; Adjusted R Square = 0.346; F (2, 228) = 61.84(p<.001)

## Chapter Summary

This chapter discussed the second experiment of this dissertation. In Study 2, the effects of VAs' nonverbal cues on perceptions of the VA as well as the RS were examined. To test the influences of similarity and authority of VAs' nonverbal cues, outfit and age of the VA were manipulated. Findings partially supported the hypothesized relationships. Results showed that the outfit of VAs significantly influenced RS users' perceptions of VA expertise. VAs with uniforms were perceived as having more expertise than VAs with casual outfits. A marginally significant influence

of VAs' age on RS users' perceptions of VA attractiveness was also found. RS users perceived similar aged VAs as more attractive than older aged VAs. In addition, similar to Study 1, the evaluations of VAs were found to significantly influence RS users' overall RS evaluations, which confirms the important role of VAs in RS evaluations. Further, the results showed significant impacts of RS evaluations on users' perceptions toward the recommendation as well as their behavioral intentions. The perceived trustworthiness of RSs was found to increase RS users' perceived fit of the recommendation as well as intentions to visit to the recommended destination. Also, RS liking enhanced perceived attractiveness of the recommended destination. Consistent with the findings of Study 1, RS users' perceptions of destination attractiveness and perceived fit of the recommendation were found to influence behavioral intentions to travel to the destination. Specific results for each hypothesis are presented in Table 37.

**Table 37.**

Summary of Support for Hypotheses of Study 2

<i>Relationship</i>		<i>Results</i>		
<b>The Effects of Outfit on VA &amp; RS Evaluations</b>		S	NS	PS
<b>H<sub>8a</sub></b>	Users will perceive greater VA expertise when the VA wears a uniform rather than a casual outfit.	x		
<b>H<sub>8b</sub></b>	Users will perceive greater VA trustworthiness when the VA wears a uniform rather than a casual outfit.		x	
<b>H<sub>8c</sub></b>	Users will perceive greater VA liking when the VA wears a casual outfit rather than a uniform.		x	
<b>H<sub>9a</sub></b>	Users will perceive greater RS expertise when the VA wears a uniform rather than a casual outfit.		x	
<b>H<sub>9b</sub></b>	Users will perceive greater RS trustworthiness when the VA wears a uniform rather than a casual outfit.		x	
<b>H<sub>9c</sub></b>	Users will perceive greater RS liking when the VA wears a casual outfit rather than a uniform.		x	
<b>The Effects of Age on VA &amp; RS Evaluations</b>		S	NS	PS
<b>H<sub>10a</sub></b>	A VA older in age than the user leads to greater perceptions of VA expertise than a VA similar in age		x	
<b>H<sub>10b</sub></b>	A VA similar in age to the user leads to greater perceptions of VA trustworthiness than a VA older in age		x	
<b>H<sub>10c</sub></b>	A VA similar in age to the user leads to greater perceptions of VA attractiveness than a VA older in age		x	
<b>H<sub>11a</sub></b>	A VA older in age than the user leads to greater perceptions of RS expertise than a VA similar in age		x	
<b>H<sub>11b</sub></b>	A VA similar in age to the user leads to greater perceptions of RS trustworthiness than a VA older in age		x	
<b>H<sub>11c</sub></b>	A VA similar in age to the user leads to greater perceptions of RS liking than a VA older in age		x	
<b>The Effects of VA Evaluations on RS Evaluations</b>				
<b>H<sub>12</sub></b>	Perceived VA expertise positively influences perceived RS expertise, trustworthiness & liking.			x
<b>H<sub>13</sub></b>	Perceived VA trustworthiness positively influences perceived RS expertise, trustworthiness & liking.			x
<b>H<sub>14</sub></b>	Perceived VA attractiveness positively influences perceived RS expertise, trustworthiness & liking.		x	

S=Supported; NS=Not Supported; PS=Partially Supported

## CHAPTER VII

### DISCUSSION AND CONCLUSION

#### **Discussion**

The overall goal of this dissertation was to investigate factors that make travel recommender systems more credible and likable. Specifically, this study focused on the role of virtual agents (VAs) that are presented as part of the system interface and examined the influences of VAs' characteristics on recommender system users' evaluations of the agents as well as the overall RSs. Two experiments were designed to investigate whether anthropomorphic and nonverbal similarity and authority cues influence RS users' perceptions of VAs as well as RSs in terms of expertise, trustworthiness and attractiveness/liking. Anthropomorphism of VAs was manipulated with visual human-like appearance and voice output while the similarity and authority cues were tested by manipulating the VAs' age and outfit. In addition, the relationships between RS users' perceptions of the system and their evaluations of the recommendation generated by the system were investigated. Further, gender effects were also tested.

The findings of both studies partially supported the hypothesized influences of VAs' characteristics on system users' evaluations of the VA and the RS. The major findings of the study are:

- Anthropomorphism of VAs was found to somewhat influence users' perceptions (Study 1). Human-like appearance of the VA positively influenced users' VA



attractiveness ratings (H2a), but not VA expertise and trustworthiness ratings and RS evaluations. Also, voice output was found to influence only overall system liking (H4b), but not RS expertise and trustworthiness nor VA evaluations.

- As far as the effects of age and outfit of VAs were concerned (Study 2), system users perceived greater VA expertise when the agents wore a uniform rather than a casual outfit (H8a) but no other significant influences were found.
- Both studies found that the users' perceptions of VAs significantly influenced users' overall RS evaluations, which suggests that VAs play an important role in the overall evaluations of an RS. Findings showed that RS users rated the RS as having greater expertise, trustworthiness as well as liking when they perceived the VA to have greater expertise (H5 & H12). The perceived trustworthiness of VAs was also found to increase users' perceptions of RSs trustworthiness (H6 & H13) and liking (H7). No significant influence of the VA's perceived attractiveness on system users' evaluation of the RS was found.
- Gender effects with respect to perceptions of both VAs and RSs were found. Female participants were found to evaluate VAs as well as RSs generally higher in terms of expertise, trustworthiness as well as liking while no difference was observed in perceived attractiveness of VAs. This suggests that females and males evaluate RSs differently.

- RS users' perceptions of RSs seem to matter when they evaluate the recommendation generated by the RS as well as for their intentions to travel to the recommended destination. Although the specific significant relationships were somewhat different between Study 1 and Study 2, the overall results indicated important influences of users' perceptions of RSs on their recommendation evaluations as well as behavioral intentions. The results showed that RS users were more likely to think that the recommendation fit their preferences when it was generated by an RS that was perceived as having greater expertise (Study 1) or greater trustworthiness (Study 2). Their perceptions of the attractiveness of the recommended destination was also found to be higher when the destination was recommended by an RS that was perceived as more trustworthy (Study 1) and likable (Studies 1 & 2). Positive direct influences of perceived trustworthiness of the RS on users' behavioral intentions to travel to the recommended destination were found in Study 2, but no direct significant relations were found in Study 1. Both studies found significant positive influences of perceived fit and perceived attractiveness of the recommended destination on users' intentions to travel to the destination. These findings suggest that system users' perceptions of RSs have influences on their evaluations of the recommendation provided by the RSs and eventually their intentions to accept it and travel to the recommended destination.

Although the findings of this study only partially supported the expected relationships, the results provide some important insights. As discussed earlier, the findings showed that certain VA characteristics significantly influence RS user's perceptions when they evaluate VAs as well as RSs. It also was found that system users' perceptions of VAs significantly influenced their overall RS evaluations. These suggest the important role of VAs presented in RSs interfaces as they significantly influence users' perceptions of RS expertise, trustworthiness as well as liking. Enhancing these perceptions of RS expertise, trustworthiness and liking is important since the results also partially supported that these perceptions positively influence system users' recommendation evaluations as well as their behavioral intentions to travel to the recommended destination. While these insights expand our understanding of the role of VAs and also emphasize the importance of creating credible and likable RSs, the results, however, do not provide a clear answer as to what types of characteristics most effectively enhance RS credibility and liking. Rather, this study suggests more research is needed to better understand the impacts of specific characteristics of VAs presented in the RS interface.

Past studies regarding travel recommender systems have largely neglected the social role of recommender systems as advice givers which can influence users' evaluations of a system as well as the likelihood that a recommendation will be accepted. Swearingen and Sinha (2001) noted that the ultimate effectiveness of a recommender system depends on factors that go beyond the quality of the algorithm. Häubl and Murray (2003) also demonstrated that recommender systems can indeed have profound impacts

on consumer preferences and choice beyond the immediate recommendation. Thus, conceptualizing recommender systems as social actors is likely important for understanding their potential impacts.

One of the popular ways used to enhance social aspects of recommender systems is adding VAs and a growing number of RSs have VAs as a part of their interfaces to facilitate the interactions with users. However, it has not been clear whether the specific characteristics of VAs influence system users' perceptions. This study sought to close this knowledge gap. Although the results did not clarify how specific characteristics of VAs influence RS users' perceptions of RSs credibility and liking, the findings of this study emphasize the role of VAs as they influence users' overall evaluations of RS credibility and liking, their evaluations of recommendations as well as behavioral intentions to travel to the recommended destination. Further, by conceptualizing RSs as social, persuasive actors, it is believed that this study contributed to the growing literature regarding the social role of recommender systems as well as influences of virtual agents in the context of recommender systems and other interfaces.

### **Contributions and Implications**

The findings of this study provide a number of implications from both theoretical and practical perspectives. From a theoretical perspective, this study provides another approach to understanding the role of recommender systems by conceptualizing them as advice givers that interact with users socially. By applying classic interpersonal

communication theories to human-system relationships, this study expands the scope of traditional theories used in the context of studying recommender systems.

As discussed earlier, expectation status theory proposes that the members in a task group form expectations regarding others' potential performance and contribution toward the group's task based on status characteristics such as gender, age and occupation (Michener et al., 2004). This process is called "status generalization process" (Webster & Hysom, 1998). The findings of this study suggest that the status generalization process also occurs when humans do a certain task with a computer, and in particular with travel recommender systems. Study 1 found that the human-like appearance of online travel agents increased user's perceptions of agent attractiveness, while voice cues were found to enhance users' liking of RS. Study 2 additionally showed that the outfit and age of virtual agents were influential when RS users evaluated the agents' expertise and attractiveness. Further, both studies found that the users' RS perceptions are significantly influenced when they evaluate the recommendations from the system and eventually their intentions to travel to the recommended destination. These findings suggest that certain diffuse characteristics (Berer et al., 1974; Goar & Sell, 2005) of virtual agents form performance expectation states of agents as well as systems and, in turn, potentially influence RS users' behavioral outcomes. This shows the status generalization process in the interaction between recommender systems and human users.

In addition, the findings of this dissertation contribute to source factors' literature which has not progressed significantly in recent days. Both Study 1 and Study 2 found

that RS users' perceptions of the source of advice - recommender systems – bear significant influence when users evaluate the recommendations generated from the system. This suggests that the findings of source factor literature could also be true when people seek advice from computers. Furthermore, this study expands on current knowledge regarding online advice source cues by identifying an important source cue, anthropomorphism, which is of course not an important cue in human-to-human advice-seeking relationships.

As far as the media equation theory is concerned, the results of this study empirically confirm the theory that understands “Computers as Social Actors” (Reeves & Nass, 1996; Fogg, 2003). The findings suggest that human users treat virtual agents as social actors whose characteristics - such as age, outfit and voice - significantly influence users' perceptions. Thus, this study suggests the applicability of media equation theory in the context of travel recommender systems.

By applying traditional interpersonal theories, researchers can test and examine various aspects of human-recommender system interactions. This does not need to be limited to the characteristics of virtual agents but can also be applied to the characteristics of systems as a whole such as the preference elicitation process and the ways in which recommendations are presented to users. However, it needs to be noted that the unique qualities of human-recommender system interactions should be considered when applying these theories and when developing methodologies to test them.

From a practical perspective, understanding recommender systems as social actors whose characteristics influence user perceptions could help system developers and designers to better understand user interactions with systems. Such an understanding is likely important for creating more sociable, credible and persuasive recommender systems. Conceptualizing human-recommender system interactions as social exchanges means that important source characteristics identified as influential in traditional advice seeking relationships can also be seen as potentially influential in human-recommender system interactions. The findings of this study showed that the specific characteristics of virtual agents such as human-like appearance, voice output and outfit significantly influence certain perceptions. This implies that designers need to carefully think about the cues they embed in VAs to design of credible and persuasive recommender systems. The challenge for design is to find ways in which source characteristics such as similarity, likeability and authority can be manipulated and translated into concrete design features that fit within the context of recommender systems. For instance, presenting cues such as uniforms or third party seals signaling the authority of the system can increase the overall credibility of systems. Similarity between recommender systems and users can be implemented by manipulating agents' characteristics. For example, presenting the matched gender agents to users could create the perception of similarity. Manipulating personalities (e.g. extraversion or introversion) of recommender systems to match with users' by varying communication style and voice characteristics was also suggested by Hess et al. (2005) and Moon (2002). Voice interfaces can be another way to translate source characteristics into credibility-evoking recommender system design.

From a marketing point of view, the findings of this research could help marketers better know what influences consumers' perceptions when consumers judge the credibility and likability of recommender systems. Considering that, in the online environment, RSs play similar roles as human salespersons in physical stores who interact with consumers and advise consumers in terms of what to buy (Komiak & Benbasat, 2004, Komiak, Wang & Benbasat, 2005), understanding the factors that enhance the credibility and likability of recommender system can help marketers to enhance their e-services.

### **Limitations of Study and Directions for Future Research**

This study has a number of limitations. First, the hypothesized relationships were only partially supported and, thus, the study results did not fully clarify the impacts of the manipulated characteristics of virtual agents. One possible reason may be the limited interactivity of the VA. The VA manipulations in our study were static images which did not employ any nonverbal behavioral cues such as gestures, postures or facial expressions thus the manipulated cues were maybe not as apparent to system users as expected. When the overall interactivity of the VA increases, the VAs' cues of anthropomorphism, similarity and authority could be more apparent to system users. Further, the elicitation process, and therefore the interaction with the VAs was rather short, which could have been a factor in reducing its impact.

The current study suggests that more research is needed in this area. While this dissertation identified and tested a number of influential source characteristics in human-



recommender system advice seeking relationships, many other potential characteristics suggested by general communication theories such as caring, non verbal behaviors like facial expression and gestures, and humor were not examined. Those unexamined characteristics should be implemented and also empirically tested in future recommender system studies.

In addition, there are additional source characteristics that might not be prominent in influencing advice seeking relationships among human actors, but are important aspects to be considered in the realm of recommender systems. This study tested the effects of anthropomorphism, which has been found to be an important characteristic that influences interactions with technologies (Koda, 1996, Nowak & Biocca, 2003). The realness of interface agents can also be considered as a potentially influential source cue. There is some evidence that users are less likely to respond socially to a poor implementation of a human-like software character than to a good implementation of a dog-like character (Parise, Kiesler, Sproull, & Waters, 1999). In future research, such additional source cues should be identified and tested.

The identified and tested source characteristics also need to be more precisely examined. The effects of source characteristics on judgments of source credibility have been found to be complex rather than linear in previous studies conducted in human-human advice seeking contexts (O'Keefe, 2002). Since situational factors, individual differences and product type can also play a significant role in determining the recommender system credibility, relationships will have to be specifically tested for specific recommender systems to provide accurate input for design considerations.

Further, some of the source characteristics have been tested in isolation from another. In order to investigate interaction effects, different source cues should be tested simultaneously if it is possible to implement them at the same time. This will help with understanding the relationships among various source factors.

Individual user differences should also be taken into account in future research. This study found gender differences in terms of perceptions of VAs and RSs. This indicates potential influences of other individual characteristics such as ethnicity, age or internet skills on users' perceptions. These individual differences need to be investigated to better inform system design. The results also indicate that users' perceived enjoyment is an important factor that influences users' perceptions. As this study identified a suitcase VA is perceived as more enjoyable than a human VA, future research needs to more specifically investigate what cues of virtual agents and also recommender systems can enhance users' perceptions of enjoyment.

Ricci (2002) noted that travel recommender systems are ever more important in providing tourists with intelligent recommendations for various travel products. The role of a travel recommender system is certainly emphasized as growing numbers of travelers search travel information online. While previous recommender system studies saw the system as a mere tool that supports users' information search and decision making, recent studies suggest the importance of social aspects of technologies (Nass & Moon, 2000; Reeves & Nass, 1996). In accordance with this perspective, this dissertation defined travel recommender systems as advice givers that socially interact with users. While the findings of this study shed light on our understanding of factors that make travel

recommender systems more credible and persuasive, a great need for further research in this area was certainly identified.

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## APPENDIX A

**Voice Output Scripts**


<b>Homepage =&gt; 1<sup>st</sup> page of vacation preference questions</b>
Let's get started.
<b>Vacation preference Questions 1<sup>st</sup> page =&gt; page 2</b>
Great! I have an idea!
<b>Questions Page 2 =&gt; Page 3</b>
I am already thinking of a great place for you.
<b>Questions Page 3 =&gt; Page 4</b>
You are almost on your way to paradise! Just a couple more questions to answer.
<b>Analyzing page</b>
We are uploading and analyzing your data. Ready to pack your vacation bag?
<b>Recommendation page</b>
Acapulco, Mexico. I bet you will have a great time!

## APPENDIX B

## Travel Recommender System Homepage Screenshots


*Human Condition*

**TRIP  
PLANNING  
ADVISER**




Hello, I am a trip adviser and would like to help you plan your next vacation. My specialty area is Spring Break beach vacations. I will ask you several questions to help determine which destination would be best for you. Tell me what you like and I will tell you where to go!

Start your Spring Break Vacation planning!

*Suitcase Condition*

**TRIP  
PLANNING  
ADVISER**



Hello, I am a trip adviser and would like to help you plan your next vacation. My specialty area is Spring Break beach vacations. I will ask you several questions to help determine which destination would be best for you. Tell me what you like and I will tell you where to go!

Start your Spring Break Vacation planning!

## APPENDIX C

**Vacation Preference Questions**

1. Do you, or would you, keep a travel journal?

- Yes
- No

2. You prefer traveling with:

- Your family
- Friends
- Alone

3. Do you like it when somebody else plans the trip for you?

- Love it
- Like it
- Not too fond of it
- Hate it

4. If you could only take one item on your trip, which one of the following would you choose?

- Magazine
- Sunglasses
- Swimsuit
- Money
- Camera
- Cell phone
- Map

5. When you need to de-stress during your trip, which of the following would you prefer to do?

- Go out for dinner
- Go out to bar
- Enjoy a little quiet time in your hotel room
- Chill next to the pool
- Go for a long run or walk along the beach
- Get lost in a book
- Explore the area

6. If you're on a sightseeing trip and aren't sure how to get to your next destination, what do you do?

- I consult the map I keep nearby
- I ask for directions
- I refuse to admit I'm lost and keep going
- I head in any direction my mood takes me

7. Which of the following souvenirs would you most like to bring back from your trip?

- Tan
- Stories
- New friends
- Lots of cool pictures
- New outfit

8. Which of the following categories describes you best when you travel?

- Beach Bum
- Avid Athlete
- Party Animal
- Sight Seeker
- Culture Creature
- Nature Lover
- Shopperholic

9. Which of the following statements describe your travel style in a new place best?

- I want to explore a place on my own, even if it is strange and unusual
- I would use a tour guide in a really exotic place
- I prefer a guide wherever I travel

10. On the beach you like to be:

- In the water
- Under the water
- On your towel
- At the beach bar

## APPENDIX D

## Destination Recommendation Page Screen Shot



The Spring Break Vacation destination that best matches your preferences is:



### Acapulco, Mexico



This Spring Break paradise offers everything you can imagine. Pure white sands and shimmering aqua waters invite you to hang out on the beach and relax. But there is also plenty of stuff to do for those of you who want to be more active: beach volleyball, swimming, snorkeling, scuba diving, shopping, sightseeing-you name it! And at night is when this place really comes to life and the partying never seems to stop. You will go home laughing with a tan, maybe some braids or new tattoos, tons of memories, and probably a few secrets too!

[Survey](#)

## APPENDIX E

**Evaluation Survey**

**We would like to hear your opinion regarding the travel recommender system you just interacted with:**

Overall, how would you evaluate the travel recommender system in terms of the following aspects?

Uninformed	1	2	3	4	5	6	7	Informed
Unintelligent	1	2	3	4	5	6	7	Intelligent
Unknowledgeable	1	2	3	4	5	6	7	Knowledgeable
Incompetent	1	2	3	4	5	6	7	Competent
Unskilled	1	2	3	4	5	6	7	Skilled
Inexpert	1	2	3	4	5	6	7	Expert
Dishonest	1	2	3	4	5	6	7	Honest
Undependable	1	2	3	4	5	6	7	Dependable
Unreliable	1	2	3	4	5	6	7	Reliable
Untrustworthy	1	2	3	4	5	6	7	Trustworthy
Plain	1	2	3	4	5	6	7	Elegant
Unpleasant	1	2	3	4	5	6	7	Pleasant
Not nice	1	2	3	4	5	6	7	Nice
Unfriendly	1	2	3	4	5	6	7	Friendly
Dislikable	1	2	3	4	5	6	7	Likable

Now think specifically about the virtual adviser that guided you through the process.



How would you evaluate this virtual adviser in terms of the following aspects?

Uninformed	1	2	3	4	5	6	7	Informed
Unintelligent	1	2	3	4	5	6	7	Intelligent
Unknowledgeable	1	2	3	4	5	6	7	Knowledgeable
Incompetent	1	2	3	4	5	6	7	Competent
Unskilled	1	2	3	4	5	6	7	Skilled
Inexpert	1	2	3	4	5	6	7	Expert
Dishonest	1	2	3	4	5	6	7	Honest
Undependable	1	2	3	4	5	6	7	Dependable
Unreliable	1	2	3	4	5	6	7	Reliable
Untrustworthy	1	2	3	4	5	6	7	Trustworthy
Does not look human	1	2	3	4	5	6	7	Looks very human
Unattractive	1	2	3	4	5	6	7	Attractive
Not classy	1	2	3	4	5	6	7	Classy
Ugly	1	2	3	4	5	6	7	Beautiful
Plain	1	2	3	4	5	6	7	Elegant
Not Sexy	1	2	3	4	5	6	7	Sexy





**Finally, we would like to ask some questions about you.**

Have you ever used a travel recommender system before?

- Yes  
No

Which of the following best describes your usual clothing style?

- Very casual  
Somewhat casual  
Business casual  
Formal  
Other (Please specify): \_\_\_\_\_

I am . . . *Please ✓ one.*       Male       Female

What year you were born? \_\_\_\_\_

What is your ethnic origin?

- White/Caucasian  
Black/African American  
Spanish or Hispanic  
Asian or Pacific Islander  
Native American or Aleutian Eskimo  
Do not wish to comment  
Other (please specify): \_\_\_\_\_

How would you describe yourself in terms of your knowledge and familiarity with the Internet? *Please circle a response for each statement.*

	<b>Strongly Disagree</b>					<b>Strongly Agree</b>	
	1	2	3	4	5	6	7
I am very skilled at using the Internet							
I know how to find what I want on the Internet							
I know more about using the Internet than most people							

How extensively have you traveled...

	Not at all						Extensively
Within the United States	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Internationally	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

We thank you for your time spent taking this survey.  
Your response has been recorded.

## APPENDIX F

**Pre-test Survey For Spring Break Destinations**

How attractive do you find the following destinations for a spring break vacation? Please rate the attractiveness of each destination.

✓ “Don’t know” box if you don’t know the destination.

✓ “Previously visited” box if you have actually been at the destination. Thank you!

<b>Destinations</b>	<b>Not at all attractive</b>					<b>Extremely Attractive</b>					<b>Don't know</b>	<b>Previously visited</b>
	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Acapulco, Mexico	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Nassau, Bahamas	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Cabo San Lucas, Mexico	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Cancun, Mexico	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Las Vegas, NV	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Mazatlan, Mexico	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Panama City Beach, FL	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Puerto Vallarta, Mexico	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
South Beach, FL	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
South Padre Island, TX	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Miami Beach, FL	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Orlando, FL	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
New York, NY	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Clearwater Beaches, FL	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
San Diego, CA	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Daytona, Beach, FL	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Honolulu, HI	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Lake Havasu, AZ	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Phoenix, AZ	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Key West, FL	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Myrtle Beach, SC	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Montego Bay, Jamaica	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Rosarito Beach, Mexico	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Carlsbad, CA	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Reduit Beach, St. Lucia	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Palm Beach, Aruba	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Palm Springs, CA	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>
Riviera Maya, Mexico	1	2	3	4	5	1	2	3	4	5	<input type="checkbox"/>	<input type="checkbox"/>

## APPENDIX G

**Destination Attractiveness, Awareness & Prior Visiting Experience Pre-Test**

A total of 17 undergraduate students completed the questionnaire in class. The questionnaire asked respondents to rate the attractiveness of 60 different spring break vacation destinations on a 5-point scale (Not at all attractive – Extremely attractive), to indicate whether they know the destination or not and to report their prior visiting experience. 10 result destinations are presented below (Criteria: Attraction Mean Ratings > 4, Number of “Don’t know” <3, Number of previous visited < 3)

## Spring Break Vacation Destinations

<b>Destination</b>	<b>Number of “Don’t knows”</b>	<b>Number of Previously visited</b>	<b>Mean Rating (n = 17)</b>	<b>Std. Deviation</b>
Honolulu, HW	0	1	4.71	.447
Nassau, Bahamas	1	1	4.62	.507
Acapulco, Mexico	1	1	4.42	.632
Cabo San Lucas, Mexico	0	0	4.36	.795
Montego Bay, Jamaica	0	0	4.36	.800
Palm Beach, Aruba	2	0	4.17	1.144
Puerto Vallarta, Mexico	1	0	4.15	.899
Miami Beach, FL	0	2	4.15	.885
New York, NY	0	4	4.08	.975
Cancun, Mexico	0	2	4.00	.966

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Public Relations Consultant, KorCom Porter Novelli (2001-2002)

## Selected Publications:

Yoo, K.- H., & Gretzel, U. (Accepted/In press). Influence of Personality on Travel-Related Consumer Generated Media Creation. *Computers in Human Behaviors*

Yoo, K.-H., Gretzel, U. (Accepted/In press). Trust in Travel-Related Consumer Generated Media. *Information Technology & Tourism*. 12(1)

Yoo, K. - H., & Gretzel, U. (Accepted/In press). Creating More Credible Recommender Systems: The Influence of Source Characteristics on Recommender System Evaluations. In P.B. Kantor, F. Ricci, L. Rokach, & B. Shapira (Eds.), *Recommender Systems Handbook*. Vienna, Austria: Springer Verlag.

Yoo, K. -H., & Gretzel, U. (2008). What Motivates Consumers to Write Online Travel Reviews? *Information Technology & Tourism*. 10(4), 283-295

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