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2012

Informing destination recommender systems design and evaluation through quantitative research

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Abstract

Purpose - Destination recommender systems need to become truly human-centric in their design and functionality. This requires a profound understanding of human interactions with technology as well as human behavior related to information search and decision-making in the context of travel and tourism. This paper seeks to review relevant theories that can support the development and evaluation of destination recommender systems and to discuss how quantitative research can inform such theory building and testing. Design/methodology/approach - Based on a review of information search and decision-making literatures, a framework for the development of destination recommender systems is proposed and the implications for the design and evaluation of human-centric recommender systems are discussed. Findings - A variety of factors that influence the information search and processing strategies that influence interactions with a destination recommender system are identified. This reveals a great need for data-driven models to inform recommender system processes. Originality/value - The proposed framework provides a basis for future research and development in the area of destination recommender systems. The paper concludes that the success of a specific destination recommender system will depend largely on its ability to anticipate and respond creatively to transformations in the personal and situational needs of its users. Such system intelligence needs to be based on empirical data analyzed with sophisticated quantitative methods. The importance of recommender systems in tourism marketing is also discussed.

Keywords

Disciplines

Business | Social and Behavioral Sciences

Publication Details

Informing Destination Recommender Systems Design and Evaluation Through Quantitative Research

Submitted for consideration for publication
in *IJCTHR*

April 2011

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ABSTRACT

Purpose: Destination recommender systems need to become truly human-centric in their design and functionality. This requires a profound understanding of human interactions with technology as well as human behavior related to information search and decision-making in the context of travel and tourism. This paper seeks to review relevant theories that can support the development and evaluation of destination recommender systems and to discuss how quantitative research can inform such theory building and testing.

Approach: Based upon a review of information search and decision-making literatures, a framework for the development of destination recommender systems is proposed and the implications for the design and evaluation of human-centric recommender systems are discussed.

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Keywords: destination recommender system; destination choice; information search; human-centric computing; travel planning; destination marketing

Classification: conceptual paper.

Informing Destination Recommender Systems Design and Evaluation Through Quantitative Research

1. Introduction

The emergence of information technology and its broad adoption within the tourism industry has led to an explosion in the availability of destination-related information which greatly helps travelers in planning trips and/or formulating expectations about tourism experiences (Buhalis and Law, 2008). At the same time, increased availability of destination-related information can lead to information overload, creating difficulty for information seekers wanting to find relevant information (Pan and Fesenmaier, 2002). Further, this information is often presented in a way that does not match the way consumers search for information (Pan and Fesenmaier, 2006). However, consumers have increasingly come to expect truly personalized information and offers (Simonson, 2005). Thus, travel and tourism marketers find an on-going challenge to deliver tailored information to micro-markets (Anderson, 2006).

Fortunately, destination recommender systems have been developed that can simplify the decision making process by identifying alternatives that meet specific needs/desires and by providing this information in a highly personalized way (Fesenmaier, Wöber and Werthner, 2006). These systems vary in sophistication, ranging from simple retrieval or filtering applications to comprehensive recommender systems (Spiekermann and Paraschiv, 2002; Burke, 2002; Schafer, Konstan and Riedl, 2001). Although sophisticated recommender systems have been implemented for some product categories (movies, books, etc.) they are still lacking vital elements before they can match or even exceed the quality of human recommendations (Häubl and Trifts, 2000).

In order to develop into more helpful and successful decision-making support tools, that is,

tools that are able to direct potential travelers to destinations they will find most suitable for fulfilling their travel-related needs, recommender systems have to become truly human-centric in their design and functionality. Further, quantitative research based on large-scale behavioral data is needed to inform such human-centric design. Following Mazanec (2006), advanced recommender systems can be described as those systems with increased adaptivity based on extensive knowledge about the user and the capability to provide real-time personalization. Thus, these systems incorporate retrieval components that seek to identify products and services that match user specifications. Users are not always able to directly specify their preferences, however, and systems need to engage users in a dialogue similar to the interaction with a human travel counselor (Hruschka and Mazanec, 1990). In order to achieve this purpose, they argue that systems need to become sensitive to:

- The degree of precision gained of the user's consumption goals during the individual counseling interaction;
- The fulfillment of the user's aspiration level regarding the volume of information needed;
- The ability to articulate owing to the user's active or passive response style; and,
- The situation-specific importance rank order of the benefits and product attributes sought (Mazanec, 2006).

As a consequence of this higher adaptivity, advanced recommender systems should be able to substantially reduce a user's effort, which in turn, increases the enjoyment in the process of identifying potential destination recommendations (Mazanec, 2006).

A rich literature has emerged over the past three decades in the fields of consumer behavior, information search and processing, and human computer interaction that provides a substantial

foundation for the development of human-centric recommender systems. Travel and tourism

related systems, however, face an additional challenge in that they have to take into account the

idiosyncratic nature of travel behavior (Loban, 1997; Vanhof and Molderez, 1994; Ricci, 2002).

Tourism research indicates, for example, that travelers often actively seek information as part of

their travel planning effort and consider information seeking an important component of the

overall travel experience (Vogt and Fesenmiaer, 1998). These studies also suggest that the

information search process involves different hierarchical steps depending upon a number of

personal and situational factors (Jeng and Fesenmaier, 2002). In addition, variety seeking and

involvement are generally believed to be more pronounced in tourism (Bigné, Sánchez and

Andreu, 2009). Based upon this literature, as well as Mazanec's (2006) conceptualization of

intelligent travel recommender systems, this paper proposes a framework of travelers'

interactions with destination recommender systems (DRSs) that takes into account the specific

characteristics of travel information search and decision-making. The paper then elaborates on

implications for the design of DRSs as well as their evaluation and the need for quantitative

research to build the models that can makes these systems adaptive and responsive to personal

needs. Last, this paper discusses the important implications for tourism marketing that arise

from the potential of truly human-centric DRSs.

2. Factors Influencing Travel Information Search and Processing

Destination recommender systems can only be successful if their design builds on a

comprehensive understanding of travel decision making and, specifically, of travel information

search (Gretzel, Hwang and Fesenmaier, 2006). This paper extends the Gretzel et al. (2006)

original behavioral framework for destination recommender system design by positing additional

factors that should be included to make the model even more comprehensive and, thus, more responsive to travelers' needs. In particular, there are three essential factors influencing travelers' information search and processing pattern including: personal characteristics of the traveler (e.g., socioeconomic status); situational needs and constraints (e.g., trip length); and aspects of the decision-making process (e.g., the specificity of the choice task and decision frames used). The following provides a brief overview of these factors and their effects on information search and processing behavior in the context of destination choice.

2.1 Personal Characteristics of the Traveler

The literature elaborates on a number of personal characteristics that potentially influence travel information search and decision-making; the following nine characteristics have emerged as particularly important in the context of travel planning: 1) Socio-Demographics; 2) Knowledge; 3) Personality; 4) Involvement; 5) Values; 6) Attitudes; 7) Cognitive Style; 8) Decision-Making Style; and, 9) Vacation Style.

Socio-demographics. Socio-demographic characteristics have been extensively studied as explanatory variables for evoked set formation, categorization of alternative destinations, and antecedents of information processing (see for example, Mayo and Jarvis, 1981; Woodside and Lysonski, 1989; Um and Crompton, 1991; Woodside and MacDonald, 1994). Part of the reason why there is such an extensive number of studies that provide information on the influence of socio-demographic characteristics on travel information search, decision-making, and behavior, is that they can be fairly easily observed or elicited from respondents. They are also relatively stable. Both aspects provide advantages in the context of recommender systems. Also, characteristics such as age, education, income, and marital status are often employed as

surrogates for determining the travel decision-maker's resources and constraints. In terms of age, existing research indicates that older travelers tend to rely more on family and past experience as information sources (Capella andGreco, 1987) and are more interested in satisfying hedonic, aesthetic, and sign needs in the information search process (Vogt and Fesenmaier, 1998). Also, more educated travelers with higher levels of income tend to search for more information (Gitelson and Crompton, 1983; Etzel and Wahlers, 1985). Women are more likely to consider functional aspects in their information search than men (Vogt and Fesenmaier, 1998); in general, females are more comprehensive information processors who consider both subjective and objective attributes, and are more likely to respond to subtle cues than males (Darley and Smith, 1995). Income influences the constraints within which trips have to be planned and also the extent to which a trip has to be planned to avoid additional cost.

Knowledge. Travelers' knowledge is an important cognitive domain that influences information search and processing behavior as well travel decision-making (Park, Gardner and Thukral, 1988; Brucks, 1985). Knowledge, often obtained through direct experience, can be represented either as travel knowledge in general or as knowledge of alternative destination(s), or both. In either case, knowledge influences the range of alternatives considered (Snepenger et al., 1990). Further, previous experience with a destination plays an important role in terms of how a destination is categorized during decision-making processes with respect to how well the location could perform when selected as a travel destination (Woodside and Lysonski, 1989). Also, differences in the choice of destinations/attractions between first-time visitors and repeat visitors, that is, travelers that have prior experience with the destination, are prevalent. First-time visitors tend to choose destinations that are easily accessible while experienced visitors are more

likely to consider destinations with low accessibility (McKercher, 1998). In addition, more experienced visitors may want to visit novel destinations since they have already visited well-known destinations within a region or attractions within a specific destination. In this sense, repeat visitors are more selective and less prone to visit multiple destinations (Oppermann, 1992; Decrop, 1999; Hwang, Gretzel and Fesenmaier, 2002).

Interestingly, a number of different perspectives have been suggested regarding the relationship between knowledge and information search behavior. A negative relationship would imply that the more knowledge a traveler can draw on, the less information seeking will occur. In contrast, a positive relationship suggests that as people acquire more knowledge they will be more actively involved in the information search process because they can better/more easily interpret information and, thus, derive more benefits from information than people with limited knowledge. Studies also suggest an inverted U-shape function where a positive relationship exists up to moderate levels of knowledge, and a negative relationship at moderate to high levels of experience/knowledge (Punj and Staelin, 1983; Alba and Hutchinson, 1987; Moorthy, Ratchford and Talukdar, 1997). Knowledge and previous experience have been included in several studies within the context of travel information search (Manfredo, 1989; Snepenger et al., 1990; Perdue, 1993). Although the results vary from study to study, two findings regarding the influence of travel/destination knowledge and/or experience on information source use are especially interesting and relevant for the context of designing recommender systems. A study conducted by Kerstetter and Cho (2004) demonstrated that prior knowledge encompasses two dimensions: 1) past experience; and, 2) familiarity/expertise, which independently influence individuals' search for vacation information. Inexperienced travelers to a destination are likely to search for more information than repeat visitors to minimize the risk involved in visiting an

unknown destination (Van Raaij, 1986). In contrast, experienced travelers are known to use information sources different from those used by naïve travelers. Also, inexperienced tourists appear to rely more on professional sources than experienced tourists (Snepenger et al., 1990; Woodside and Ronkainen, 1980). In addition, Vogt and Fesenmaier (1998) find that experienced tourists tend to have higher innovation needs than inexperienced tourists. This can be interpreted as resulting from a greater tendency of experienced travelers to seek variety and, thus, more novel information.

    <u>Involvement</u>. Travel information search and processing also depend to a great extent on individuals' level of involvement (Finn, 1983; Celsi and Olsen, 1988; Jamrozy, Backman and Backman, 1996). For example, as the perceived risk involved in the decision task increases, situational involvement rises accordingly, and individuals tend to invest more resources in external information search (Murray, 1991). That is, highly involved travelers are likely to use more criteria, search for more information, use more information sources, process relevant information in detail, make more inferences, and will form attitudes that are less likely to change (Celsi and Olsen, 1988; Fesenmaier and Johnson, 1989). In a complex decision and choice situation there is a greater need to develop commitment and stronger attitudes in order to accomplish the task. On the other hand, simple and routine decisions require relatively low consumer involvement (Reid and Crompton, 1993). Fesenmaier and Johnson (1989) use the individual's trip planning involvement as the basis for segmenting the Texas travel market. They find that low-involvement travelers tend to have a shorter planning horizon, while the medium-high involvement travel group shows a longer trip planning horizon. Importantly, the longer the planning horizon, the more destination alternatives can be considered and the more extensive can

their evaluation be. In addition, the results of their study indicate that low-involvement tourists take shorter getaway trips that involve less resource constraints and less risk factors, whereas highly involved tourists tend to take longer vacations which require extensive cognitive efforts, advance planning, and entail more resource constraints and risk factors.

    Personality. Personality, which can be defined as "the reflection of a person's enduring and unique characteristics that urge one to respond in persistent ways to recurring environmental stimuli" (Decrop, 1999, p. 106), is a "complex outcome of a person's learning, perceptions, motivations, emotions, and roles" (Mayo and Jarvis, 1981, p. 109). Plog (1994) suggests two fundamental personality dimensions that are of importance within the context of tourism: allocentricism and psychocentricism. Allocentric travelers, who exhibit a self-assured and venturesome personality, are more likely to choose exotic destinations while psychocentric travelers, whose center of attention is focused on self-doubts and anxieties, are thought to prefer familiar destinations (Plog, 1994; Ross, 1994). Griffith and Albanese (1996) show that Plog's model can be used to characterize travelers in terms of their psychographics and suggest practical use of these traits to make destination recommendations.

    Further, personality traits related to locus of control and risk avoidance, which influence an individual's decision-making style, play an important role in any decision-making process but are of particular importance for destination choice processes because of the high levels of uncertainty involved (Roehl and Fesenmaier, 1992). Variety-seeking is another personality trait that is of great importance for tourism decisions but existing recommender systems typically fail to take variety-seeking into account (Dholakia and Bagozzi, 2001). Personality has also been identified as a factor with considerable influence on information search and processing

strategies. For example, individuals' differences in the complexity of the causal explanations they reach to make sense of their environments suggest that personality influences the extent and nature of information search and integration patterns (Murphy, 1994). Also, individuals with a tendency to postpone decisions when faced with difficult choices or conflicts have been found to engage in search patterns that are different from those used by individuals who are not indecisive (Ferrari and Dovidio, 2001). Recent recommender system research also suggests that personality is an important factor to consider when providing recommendations (Gretzel, Mitsche, Hwang and Fesenmaier, 2004; Moon, 2002).

    Values. Madrigal and Kahle (1994) define personal values as representing central beliefs about desirable states or behaviors. Thus, the structure of an individual's value system provides the basis for deriving intentions and directing human behavior. Woodside and Lysonski (1989), for example, argue that personal value systems influence travelers' destination awareness. In contrast, Um and Crompton (1991) describe personal values as an internal input that initiates the formation of an evoked set from an awareness set. In tourism research, studies by Madrigal (1995) indicate that personal values are a better predictor of choice between group tours and individual tours than personality, and Zins (1998) suggests that personal values are an important antecedent variable for hotel choice. Examples of values are self-respect, sense of accomplishment and being well respected by others. While many individual values exist, the literature has identified four broad dimensions of values, namely enjoyment, achievement, egocentrism, and external orientation (Madrigal and Kahle, 1994).

    Attitudes. The destination images created through prior experience or exposure to advertising

and marketing efforts, and the fit between conceptions of the destinations with personal values and beliefs result in particular attitudes toward destinations. These attitudes are significant determinants of whether or not a destination is considered as an alternative and how the destination is evaluated in later stages of the destination choice process. Research by Fishbein and Ajzen (1975), among others, relates personal attitudes to subsequent behavior, arguing that they play an important role in understanding destination choice. The attitude-behavior model provides explanations for human behavior based on individual attitudes and the behavioral intentions that can be derived from them (Ajzen and Fishbein, 1980; Ajzen, 1991). Within the context of destination choice, Um and Crompton (1990) operationalize attitude toward alternative destinations as the difference between the magnitude of the perceived facilitators and the magnitude of the perceived inhibitors, and argue that destinations with higher attitude scores are more likely to be included in the evoked set and, ultimately, are more likely to be selected as the final destination.

Cognitive Style. Travelers differ in their perceptions and preferences for types of information. The preferred ways in which individuals process information are referred to as cognitive style (Biocca et al., 2001). Cognitive styles affect information gathering, evaluation, and selection processes in the context of vacation trip planning (Grabler and Zins, 2002). Rumetshofer, Pühretmair and Wöß (2003), and Rosen and Purinton (2004), demonstrate that information presentation needs to match the cognitive style of the traveler in order to be effectively processed.

Decision-Making Style. Decision-making styles are mainly viewed as a mental, cognitive

orientation towards shopping and purchasing (Sproles and Kendall, 1986) or a learned habitual pattern (Scott and Bruce, 1995), which dominates the consumer's choice and constitutes a relatively enduring consumer personality. Decision-making styles basically describe how individuals shop. Sproles and Kendall (1986) combine related traits described in the literature to develop a consumer decision-making styles list, the so-called consumer styles inventory (CSI), consisting of the following eight dimensions: 1) perfectionism; 2) brand consciousness; 3) novelty/fashion consciousness; 4) price/value consciousness; 5) recreational shopping; 6) impulsive/careless shopping, 7) confusion by over-choice; and, 8) habitual/brand loyal shopping. The CSI has been tested in the context of online shopping (Yang and Wu, 2006; Cowart and Goldsmith, 2007; specifically, Park, 2007) and the results indicate that decision-making styles substantially influence the online purchase of travel products and loyalty toward online travel agencies.

   Vacation Style. Vacation styles combine psychographic characteristics such as travel motives with behavioral patterns (Zins, 1999). They have emerged from earlier tourist type research seeking to identify traveler segments that fundamentally differ in terms of the benefits sought from vacations (Dolnicar and Mazanec, 2000). Vacation styles have been found to provide a rather stable criterion for marketing segmentation (Dolnicar and Leisch, 2003) and can be seen as strong determinants of trip preferences. Not all destinations cater equally well to the different vacation style types due to differences in offerings. Thus, identifying someone's vacation style seems to be very beneficial in the context of making a destination recommendation.

2.2 Situational Needs and Constraints

Destination related decisions are highly sensitive to the situation in which they occur. The travel literature indicates that trip characteristics are, as one would expect, the most important determinants and include travel purpose, length of travel, distance between origin and destination, travel group composition, as well as travel mobility. The following provides a brief discussion of each as they relate to travel information search and decision-making.

Travel purpose. Travel purpose can be generally defined as one's stated needs or motives for travel. Travel purpose is, often times, closely connected to activities and settings (e.g. golf vacation or visit to a cultural heritage site) and therefore, significantly constrains/defines the range of alternative destinations considered. Travel purpose also influences information search strategies. Fodness and Murray (1998) find that those traveling for vacation purposes are the most likely to rely on their personal experience to plan their trips.

Trip length. The time available for a trip constrains the geographical range of the trip. Thus, travelers with limited amounts of time available tend to prefer nearby destinations. In contrast, travelers with more time tend to prefer more distant destinations (McKercher, 1998). In this sense, length of trip constrains the range of alternatives that will be considered. Length of travel has also been identified as a factor that influences the use of particular information sources (Snepenger et al., 1990).

Travel distance. Whether a destination will be considered as an alternative is also a function of the distance from home to a destination, a factor which has been included as a key variable in aggregated destination choice models (Kim and Fesenmaier, 1990; Lo, 1992). In disaggregated

models, cognitive distance instead of physical distance has been emphasized to account for circumstances in which individuals use mentally measured proximity or distance to evaluate alternatives. Empirical evidence suggests that there is a relationship between travel distance and information search strategies. For example, Pennington-Gray and Vogt (2003), among others, find that out-of-state visitors are more likely to obtain travel information at welcome centers than in-state residents.

    Travel party. Alternative destinations considered by a person who plans to go on a family vacation, for example, are probably different from those considered for a trip with friends. The characteristics of the travel party also impact the geographical range of alternative destinations in respect to the mobility of the travel group. A family with children tends to take short vacations at easily accessible destinations. In contrast, couples without children are more likely to choose destinations with modest accessibility (McKercher, 1998). Additionally, the nature of the travel party defines the degree of heterogeneity in the group with respect to interests. That is, as the travel party size increases, the number of needs to gratify is likely to increase accordingly and thus, multidestination travel is more likely to occur (Fesenmaier and Lieber, 1985, 1988; Lue, Crompton and Fesenmaier, 1993). In addition, travel group composition has been found to influence the information search strategy selected (Fodness and Murray, 1997). Family groups tend to use media as information sources more than other types of travel parties, and are more likely to be involved in extensive search processes in order to assure satisfaction of all the members (Gitelson and Crompton, 1983).

    Travel mobility. Mobility is not only a function of the nature of the travel group but also

depends on the transportation mode a traveler uses during a trip (Tideswell and Faulkner, 1999).

Alternative destinations, which a traveler with a rental car or personal car can think of, might be unavailable to travelers who use, for instance, only public transportation. Travel mobility has an impact on the flexibility of the travel itinerary and is positively related to not only the number of destinations but also the number of attractions and activities that can be integrated into the trip. Transportation mode used can also explain certain tendencies toward multidestination travel as travelers with greater mobility are better equipped for visits to more than one destination (Cooper, 1981). Further, Fodness and Murray (1999) find evidence for a relationship between mode of transportation and types of travel information sources used. Thus, a DRS needs to gauge the level of travel mobility a user has during a specific trip in order to make reasonable recommendations.

2.3 **Decision Frames**

Destination decisions can be framed in various ways depending on personal preferences for certain decision-making strategies and the needs or constraints derived from the specific trip planning situation. Specifically, the number and type of decision criteria taken into account will vary based on the nature of the trip to be planned. For instance, trips defined around a specific activity such as golfing will strongly influence the frame in which the decision has to be made. For such a trip, beach access at the destination might be desired but might not be perceived as being as important as in the case of a typical summer, sun, and beach vacation. Also, personal characteristics can be assumed to influence one's need, ability, and/or willingness to take certain criteria into consideration. A low annual household income, for instance, will probably encourage the adoption of a decision frame that incorporates price as a main criterion. In

addition, personal cognitive styles can greatly influence the amount of information sought to support the decision-making process and especially the number of alternatives considered by the individual decision-maker (Hunt et al., 1989; Driver, Brousseau and Hunsaker, 1990). Similarly, decision-making styles will influence the timing of the decision, the extent of planning and specific criteria taken into account. For instance, an impulsive style will lead to very little planning and a small number of decision criteria while brand consciousness results in a focus on well established travel product and services brands (Sproles and Kendall, 1986).

Further, destination decisions can be taken at different levels in the travel planning hierarchy, that is, one can select a main destination, a secondary destination, or places within a destination such as attractions and restaurants (Jeng and Fesenmaier, 2002). Given the impact of choosing a main destination on decisions with respect to lower-level facets of a trip, being in the process of selecting the main destination of a trip implies that many characteristics of this trip are still undetermined. In contrast, if the main destination has been chosen and the decision-making process refers to finding one or more secondary destinations, one can assume that many important characteristics of the trip have already been outlined and that the range of destination alternatives in the consideration set will be rather limited. At the most specific level, destination decisions involve choosing places to visit at a destination. This latter form of destination decision can be characterized by a high level of constraint and, consequently, a relatively small number of alternatives to be considered.

Depending on the specificity of the destination decision, the amount and type of information taken into account in the decision-making process will vary (Bloch, Sherrell and Ridgway, 1986). More specific destination decisions require more specific information. If no destination decision has been made, the information sought will be in the general form of destination

alternatives and will often be more image-based than functional. If a main destination has been selected, the destination decision will focus on secondary destinations in proximity to the main destination. Such a decision requires image-related information but also more specific details about distances and activity/attraction portfolios to evaluate destination complementarities. Finally, those decisions that involve selecting places/attractions at a specific destination will to a large extent include detailed and more functional information in the form of opening hours, prices, admission restrictions, etc. Therefore, knowing the level of specificity of a user's decision-making process is a critical success factor for a human-centric DRS (Mazanec, 2002; Hwang, Xiang, Gretzel and Fesenmaier, 2009).

3. A Framework for Human-Centric Destination Recommender Systems

Based on the review of the travel destination choice and information search and processing literatures, a framework can be conceptualized which integrates various factors that shape an individual's interaction with a destination recommender system (see Figure 1). The framework assumes that individuals access a DRS to learn about alternative destinations and that the nature of the information needed by a user will depend on two main factors: 1) the decision task(s) to be accomplished; and, 2) the nature of the trip, that is, the context in which this trip decision will be taken. Further, the decision task(s) depends on the decision frame that guides the decision making process. The nature of the trip, on the other hand, will depend on the situational needs to be satisfied by the trip and the constraints that have to be considered. Although destination decisions are often high-level decisions and are typically made when most other aspects of the trip are still undefined, individuals who use a DRS are expected to have at least some idea of when they would like to travel (e.g. winter versus summer vacation), how long they would like

to stay (e.g. week-long vacation or getaway trip), who they would like to take along (e.g. spouse or entire family), what the purpose of the trip is (e.g. relaxation versus adventure), what main activity they will engage in (e.g. beach vacation versus skiing trip), what the main mode of transportation will be (e.g. car versus airplane), and from which point of origin the trip will start. If the main destination has been selected and the search effort focuses on secondary destinations or attractions within destinations, the situational needs and constraints are assumed to have been established in greater detail. Thus, the specific decision task is shaped by the decision frame selected, which is, of course, *a priori* adjusted to accommodate the specific aspects of a trip. Furthermore, the needs and constraints that drive the nature of the trip are important indicators of the particular decision task to be accomplished as they directly influence the nature of the trip, but also affect the way the destination decision is framed and executed.

<div style="text-align:center">Insert Figure 1 about here</div>

Information search, processing, and evaluation in the context of travel planning are complex and iterative (Pan and Fesenmaier, 2006). A truly adaptive system as described by Mazanec (2006) engages the user in a dialogue and allows for re-specifications of needs by the user and adjustments in recommendations by the DRS. The proposed framework is dynamic in the sense that it recognizes the importance of feedback resulting from a user's interaction with the system. Based on the processing and evaluation of the recommendations obtained, the user might decide that more/better information is needed and therefore might engage in additional information search processes until a satisfactory level is reached. In a different case, the information obtained from the system could expose additional situational constraints and make changes in the decision frame and/or the nature of the trip necessary. For instance, destinations could be

recommended and perceived as being optimal in terms of the activities they provide, the way in which they cater to the needs of the members of the travel party, etc. However, they could be seen as offering too many interesting things for just a day trip and lead to a revision of the trip length constraint. Similarly, a user could be given the options of loosely specifying trip characteristics in the beginning of the search process and would subsequently be encouraged to refine them as more information is being taken into account. Ideally, the process ends when all necessary information has been collected and processed and an informed destination decision is made. The time and number of iterations necessary to reach this point will vary depending on the number of potential alternatives under consideration, the quality of the recommendations and the changes in the decision frame as set by the user. The worst-case scenario in terms of behavioral outcomes is, of course, a situation whereby the user terminates the process without having reached a decision. Alternatively, use of the system could lead to a postponing of the decision, but at least with a narrowed-down set of alternatives.

3.1 System-User Interaction

The nature and degree of interaction with the system is driven by personal characteristics, situational factors and the resulting nature of the trip to be planned, the decision frame applied and the specific decision(s) to be taken, which all result in particular information needs and search strategies. However, interaction can also be directly influenced by personal characteristics. An individual's skills, involvement, personality, etc. appear to have direct impacts on the individual's interaction with an intelligent information environment such as a DRS (Hoffman and Novak, 1996). Further, numerous studies on interactions with technologies and specifically with recommender systems, point out that trust is an important characteristic in

the interaction with a system (Komiak and Benbasat, 2006; Swearingen and Sinha, 2001). Whether trust can be established depends on factors such as personality (e.g. neuroticism negatively influences trust), knowledge of recommender systems, perceived credibility of the system (Yoo and Gretzel, 2011), attitudes toward technology in general and especially the Internet, gender (e.g. Gefen and Straub, 1997) and age (Fox and Boehm-Davis, 1998). Innovativeness refers to a user's desire to be among the first to adopt a product or a technology (Goldsmith and Hofacker, 1991) and is also an important construct that has been studied in the context of technology adoption and use. The more innovative a user, the more open he or she is to novel forms of interactions.

3.2 System Characteristics

In addition to user characteristics, a user's interaction with a DRS is shaped by the characteristics of the recommender system itself. The design elements of a DRS play a crucial role in shaping the user-system interaction process. Specifically, the amount and presentation of the DRS's content and the structure of its interface are key aspects determining the nature of the interaction (Spiekermann and Paraschiv, 2002; Dholakia, Zhao, Dholakia and Fortin, 2000). Zins (2003) concludes that adaptation of information provided by a DRS and adjustment of the recommender system interface to fit a user's cognitive style are crucial for improving the quality of the human-computer interaction. Further, the intelligence built into the system through data storage and mining capabilities influences the level of interactivity and personalization that can be provided. System intelligence, therefore, is a core element in defining user interactions with a DRS. Thus, the framework clearly supports the idea that DRSs should be highly interactive and adaptive in order to provide appropriate guidance in the travel planning process. Another

important capacity of a DRS, which is rooted in its design, is its ability to provide users with enjoyment and excitement as well as types of information exchanges that can convey the experiential aspects of travel and tourism products/services. Figure 2 summarizes these core DRS design components. Each of these design components has to be informed by the theoretical foundations outlined above to truly support destination decision-related human behavior.

<center>Insert Figure 2 about here</center>

4. Implications for Recommender System Design

Although some of the relationships in the proposed theoretical framework appear to be obvious, they are often not implemented because more emphasis is placed on technical considerations than user interaction requirements, and system designers typically lack an understanding of the foundations of travel behavior. Such an understanding is critical in designing systems that can support different stages in the travel planning process and can provide the adaptivity that is usually offered by human travel counselors. Most importantly, the interaction with the system should feel natural and provide enjoyable experiences. Three propositions can be derived from the theoretical framework and should guide future DRS development:

Proposition 1: Truly human-centric destination recommender systems need to be able to take into account situational needs/constraints, decision frames, as well as personal characteristics.

Proposition 2: Truly human-centric destination recommender systems need to support reiterative planning and provide opportunities for feedback and modification.

Proposition 3: System intelligence is crucial in providing persuasive

recommendations but destination recommender systems also need to offer experiential and enjoyable use experiences as travel planning is an important component of the pre-trip experience. Such high quality interactions are not only dependent on system design characteristics but also on the system's ability to adapt to information search and processing strategies as well as personal characteristics and styles of the user.

5. Implications for Research

The proposed framework illustrates the myriad of factors that can influence successful interactions with a DRS and the great number of attributes that could potentially be taken into account when the system seeks to provide a suitable destination recommendation. In practice, it is computationally impossible for a system to take into account all possible personal characteristics, decision frames and trip characteristics that influence the destination choice process. Adaptive systems have the advantage that they can learn from the interaction with the user and dynamically adjust the criteria taken into account. However for such a system to be designed, detailed information on the relative importance of criteria and their interrelationships is needed. Research has yet to provide the necessary insights to determine which aspects of the framework are more important than others. Also, determining more general user profiles based on the elements of the framework requires more empirical evidence. Data-mining of existing online recommendation systems will be instrumental in providing the information needed to successfully adapt recommender systems to the travel and tourism context as well as to specific customer needs (Markellou et al., 2005). Thus, collaborative research that involves tourism academics, system designers and tourism organizations that have implemented systems will be critical. In addition, classifying destinations so that they can be successfully matched to

particular traveler preferences and needs might be necessary to overcome some of the limitations recommender algorithms have. This requires a thorough understanding of destination attributes and constraints (distance, opening hours, etc.).

While qualitative research can provide important insights as to how users engage with information and systems as well as with other members of their travel party when planning vacations, quantitative research is needed to develop the weights, cases, matching algorithms, learning strategies, and interaction protocols that combine into system intelligence. For an overview regarding Web usage mining research see Pierrakos et al. (2003). Especially data extraction and preparation are critical issues for web mining but have not been extensively discussed in the literature. One specific method that can help with deriving information from weblog data about travel planning processes is the sequence alignment method. Currently underused in tourism, this method allows for the recognition of patterns in the behavioral sequences of travelers' interactions with online systems (Liu, 2007). Navigational patterns are behavioral data that can provide critical insights as to how consumers search for information. The ultimate goal is to be able to successfully predict the next user action or information need based on the user's previous surfing behavior (Hay, Wets and Vanhoof, 2003).

Another critical area of quantitative research needed to inform DRS design is cluster analysis, which has a long tradition in tourism research (Mazanec, 2000; Dolnicar, 2002; Zins, 2008). However, intelligent systems such as DRSs need sophisticated clustering approaches. Such segmentation analyses have to be based on a thorough understanding of the underlying data structures (Dolnicar and Leisch, 2010). Neural network approaches, for instance, have been proven to outperform other types of cluster analyses (Buchta et al., 1997) but are still not widely used in tourism research.

The framework outlines the scope of research that has to be conducted. While some of the findings from general recommender systems research can be used for DRS design, others have to be specifically established in the context of tourism. Mazanec (2006) also points to the necessity of employing and developing new research methodologies in the context of establishing the theoretical basis for DRS design and evaluating existing prototypes.

Travel and tourism marketers will also have to establish performance measures to benchmark and assess the return on investment a DRS provides. Currently used Web metrics such as unique visitors and number of bookings are of little relevance for systems that are usually only used for decision support rather than execution and whose goal is to expose consumers to highly tailored information rather than maximizing impressions. Henry (2005) suggests that consumers judge a DRS against the notion of a "live, adaptable expert" (p. 359) and that this measure, although maybe not immediately available, provides a more realistic and useful evaluation of a system's worth because the system centers on the consumer's perspective.

Given this discussion, the following guidelines for future research in the area of destination recommender systems are proposed:

Proposition 4: The identification of a hierarchy of factors ranging from most critical/discriminating to supplementary needs to be established so that DRS design can be informed.

Proposition 5: Measures of success that take the human-centeredness and adaptivity of a DRS as well as concrete benefits for tourism marketers into account need to be established.

Proposition 6: New research methodologies need to be developed to better capture insights from behavioral data and to better and more efficiently classify

destinations and segment travelers.

6. Conclusion

The rich information search and decision-making literatures offer a tourism-specific theoretical framework that can be used as a basis for the design of human-centric destination recommender systems. The outcome of this effort is a framework which should guide system development and which emphasizes the diversity of factors that drive destination decisions. Importantly, the framework and the guidelines derived from it simultaneously represent the starting point in the development of an effective travel recommender system and a road map for future research. There is much evidence that online recommender systems can effectively guide consumer decision-making. Amazon.com is one of the most popular examples of an effective online recommender system as the Web site offers a variety of entry points, multiple formats with which to evaluate potential products, and intelligent mining approaches which help to track consumer purchasing behaviors and interests.

Although the framework has been established in the context of a pre-travel DRS, its overall structure can also be applied to the design of context-aware, mobile systems that typically cater to lower-level decisions when the user is already at the destination. Various elements that the framework stresses have been implemented in the design of such systems. Kramer et al. (2006), for example, demonstrate the importance of exploring different preference elicitation strategies in the case of a mobile dynamic tour guide. Adaptive interfaces have been discussed in the context of PALIO, a location-aware information system for tourists (Zarikas, Papatzanis and Stephanidis, 2001). Nguyen, Cavada and Ricci (2004) emphasize the importance of integrating user feedback into an on-the-move restaurant recommender system. Recently, system design efforts have also discovered the importance of travel party composition and the need to integrate

group decision-making support into travel recommender systems (see for instance Ardissono et al., 2003). Decision frames might also be influenced by roaming costs or lack of ubiquitous high-speed wi-fi access. Yet, no system currently offers comprehensive adaptation that reflects all areas put forward by the theoretical framework. Consequently, the framework provides an important way to inform the development of newly emerging travel recommender systems, whether they focus on pre-travel or en-route recommendations.

An interesting and important issue is the impact of adaptive systems on consumer behavior and the evolution of these systems as a form of persuasive technology (Fogg, 2003). Recently, a number of scholars have begun to consider the potential impact of recommender systems, providing considerable insight into current and potential relationship(s) between computers and users (Nass and Moon, 2000; Häubl and Murray, 2003; Cosley et al., 2003). A main assumption of this research is that recommender systems are quasi-social actors (Nass, Steuer, and Tauber, 1994). Dholakia and Bagozzi (2001) provide an excellent discussion of the various roles of online technologies and consumer behavior where they argue that Web-based systems can effectively reduce cognitive effort, transfer control from self to the system, and positively affect the quality of actual decisions. However, there are a number of concerns regarding the use of these systems including the ease with which one can mask the true intent of the system, the degree to which systems can manipulate the set of alternatives under consideration, as well as the ability of the these systems to affect emotions. Clearly, the nature and extent to which such technologies can be used to manage consumer behavior should be discussed and guidelines need to be established. Another important issue focuses on the emergence of the "new consumer" and related implications concerning the next generation of online destination recommender systems. Given the changing nature of the traveler and the use of Internet-based systems (Cho and Jang, 2008; Poon, 1993; Kramer, Modsching, Hagen and Gretzel, 2007), the success of a specific DRS

will largely depend on its ability to anticipate and creatively respond to transformations in the personal and situational needs of its users.

Destination recommender systems are important tools for online travel and tourism marketing. They not only provide cross-selling and up-selling opportunities but by addressing individual customer needs they also have the potential to greatly increase satisfaction, promote loyalty and establish one-to-one relationships (Markellou, Rigou and Sirmakessis, 2005). Recommender systems increase the relevance of information provided to the consumer, which increases the likelihood that the information is actually processed (Shavitt and Brock, 1994). In addition, human-centric recommender systems promise marketers the ability to reach consumers with very specific needs that are typically excluded in mainstream marketing campaigns. The marketing literature suggests that the number of consumers with obscure preferences is growing and marketing strategies should be tailored to reach these long tails of the consumer preference distribution curve (Anderson, 2006). Recommender systems provide a potential solution to reaching these "markets of one" (McKenna, 2000). As such, they challenge traditional assumptions regarding market segmentation and target market selection where the goal is no longer to invest only in large groups (segments) of travelers that can be addressed in a uniform way based on common demographics or trip motivations. Indeed, Werthner and Ricci (2004) anticipate that recommender applications will have a great impact on travel information distribution and consumers' travel planning behavior. Therefore, it will be crucial for travel and tourism marketers to influence the design of such systems and to make the best use of capabilities. This will not only require a better understanding of the increasingly diverse needs and expectations of consumers, but also calls for substantially new marketing models.

7. Acknowledgement

8. References

Ajzen, I. (1991), "The theory of planned behavior", *Organizational Behavior and Human Decision Processes*, Vol. 50 No. 2, pp. 179-211.

Ajzen, I., and Fishbein, M. (1980), *Understanding attitudes and predicting social behavior*, Prentice-Hall, Englewood Cliffs, NJ.

Alba, J., and Hutchinson, J. (1987), "Dimensions of consumer expertise", *Journal of Consumer Research*, Vol. 13, pp. 411-453.

Anderson, C. (2006), *The Long Tail*, Hyperion, New York.

Ardissono, L. Goy, A., Petrone, G., Segnan, M., and Torasso, P. (2003), "INTRIGUE: Personalized recommendation of tourist attractions for desktop and handset devices", *Applied Artificial Intelligence*, Vol. 17, pp. 687-714.

Bigné, J.E., Sánchez, I., and Andreu, L. (2009), "The role of variety seeking in short and long run revisit intentions in holiday destinations", *International Journal of Culture, Tourism and Hospitality Research,* Vol. 3 No. 2, pp. 103-115.

Biocca, F.A., Jackson, L.A., Dobbins, H., Barbatsis, G. von Eye, A., Fitzgerald, H.E., and Zhao, Y. (2001), "Adapting computer interfaces to differences in cognitive and cultural style", Paper presented at the *Symposium on the Digital Divide*, International Communications Association (ICA) and International Association of Media and Communication Research (IAMCR), University of Texas, Austin, Texas, November 16-18.

Bloch, P.H., Sherrell, D.L., and Ridgway, N.M. (1986), "Consumer search: An extended framework", *Journal of Consumer Research*, Vol. 13, pp. 119-126.

Brucks, M. (1985), "The effects of product class knowledge on information search behavior", *Journal of Consumer Research*, Vol. 12, pp. 1-16.

Buchta C., Dimitriadou E., Dolnicar S., Leisch F., and Weingessel A. (1997), "A comparison of several cluster algorithms on artificial binary data scenarios from travel market segmentation", Working Paper # 7, SFB Adaptive Information Systems and Modelling in Economics and Management Science, Vienna, Austria.

Buhalis, D., and Law, R. (2008), "Progress in information technology and tourism management: 20 years on and 10 years after the Internet – The state of eTourism research", *Tourism Management*, Vol. 29, pp. 609-623.

Burke, R. (2002), "Hybrid recommender systems: Survey and experiments", *User Modeling and User-Adapted Interaction*, Vol. 12, pp. 331-370.

Capella, L.M., and Greco, A.J. (1987), "Information sources for elderly vacation decisions", *Annals of Tourism Research*, Vol. 14, pp. 148-151.

Celsi, R., and Olsen, J. (1988). "The role of involvement in attention and comprehension processes", *Journal of Consumer Research*, Vol. 15, pp. 37-47.

Cho, M., and Jang, S. (2008), "Information value structure for vacation travel", *Journal of Travel Research*, Vol. 47 No. 1, pp. 72-83.

Cooper, C.P. (1981), "Spatial and temporal patterns of tourist behavior", *Regional Studies*, Vol. 15 No.3, pp. 359-371.

Cosley, D., Lam, S.K., Albert, I., Konstan, J.A., and Riedl, J. (2003), "Is seeing believing? How recommender interfaces affect users' opinions", *Proceedings of the CHI 2003 Conference*. ACM, New York.

Cowart, K.O., and Goldsmith, R.E. (2007), "The influence of consumer decision-making styles on online apparel consumption by college students", *International Journal of Consumer Studies,* Vol. 31 No. 6, pp. 639-647.

Darley, W.K. and Smith, R.E. (1995), "Gender differences in information processing strategies: An empirical test of the selectivity model in advertising response", *Journal of Advertising*, Vol. 24 No. 1, pp. 41-56.

Decrop, A. (1999), "Tourists' decision-making and behavior processes", Pizam, A., and Mansfeld, Y. (Eds.), *Consumer behavior in travel and tourism,* The Haworth Hospitality Press, Binghamton, New York, pp. 103-134.

Dholakia, U.P., and Bagozzi, R.P. (2001), "Consumer behavior in digitial environments", Wind, J., and Mahajan, V. (Eds.), *Digital Marketing: Global Strategies from the World's Leading Experts,* John Wiley & Sons, New York, pp. 163-200..

Dholakia, R.R., Zhao, M., Dholakia, N., and Fortin, D.R. (2000), "Interactivity and revisits to Websites: A theoretical framework", RITIM working paper. Accessed December 13, 2004 at: http://ritim.cba.uri.edu/wp2001/wpdone3/wpdone3.htm

Dolnicar S. (2002), "Review of data-driven market segmentation in tourism", *Journal of Travel & Tourism Marketing*, Vol. 12 No. 1, pp. 1-22.

Dolnicar, S. and Leisch, F. (2003), "Winter tourist segments in Austria – Identifying stable vacation styles for target marketing action", *Journal of Travel Research*, Vol. 41 No. 3, pp. 281-293.

Dolnicar S., and Leisch, F. (2010), "Evaluation of structure and reproducibility of cluster solutions using the bootstrap", *Marketing Letters*, Vol. 21 No. 1, pp. 83-101.

Dolnicar, S., and Mazanec, J.A. (2000). "Vacation styles and tourist types: Emerging new concepts and methodology", Gartner, W., and Lime, D.W. (Eds.), *Trends in Outdoor Recreation, Leisure and Tourism*, CABI, New York, pp. 245-256.

Driver, B.L., Brousseau, K.R., and Hunsaker, P.L. (1990), *The dynamic decision-maker: Five decision styles for executive and business success,* Harper & Row, New York.

Etzel, M.J., and Wahlers, R.G. (1985), "The use of requested promotional material by pleasure travelers", *Journal of Travel Research*, Vol. 23 Spring, pp. 2-6.

Ferrari, J.R., and Dovidio, J.F. (2001), "Behavioral information search by indecisives", *Personality and Individual Differences*, Vol. 30, pp. 1113-1123.

Fesenmaier, D.R., and Johnson, B. (1989), "Involvement-based segmentation: Implications for travel marketing in Texas", *Tourism Management*, Vol. 10, pp. 293-300.

Fesenmaier, D.R., and Lieber, S.R. (1985), "Spatial structure and behavior response in outdoor recreation participation", *Geografiska Annaler B*, Vol. 67, pp. 131-138.

Fesenmaier, D.R., and Lieber, S.R. (1988), "Destination diversification as an indicator of activity compatibility: An exploratory analysis", *Leisure Sciences*, Vol. 10 No. 3, pp. 167-168.

Fesenmaier, D.R., Werthner, H., and Wöber, K. (Eds.) (2006), *Destination Recommendation Systems: Behavioural Foundations and Applications*, CABI, Cambridge, MA.

Finn, D. (1983), "Low involvement isn't low involving", Bagozzi, R.P., and Tybout, A. (Eds.), *Advances in Consumer Research,* Association for Consumer Research, Ann Arbor, MI, pp. 419-424.

Fishbein, M., and Ajzen, I. (1975), *Belief, attitude, intention, and behavior: An introduction to theory and research*. Addison-Wesley, Reading, MA.

Fodness, D., and Murray, B. (1997), "Tourist information search", *Annals of Tourism Research*, Vol. 37 No. 2, pp. 108-119.

Fodness, D., and Murray, B. (1998), "A typology of tourist information search strategies", *Journal of Travel Research*, Vol. 37, pp.108-119.

Fodness, D., and Murray, B. (1999), "A model of tourist information search behavior", *Journal of Travel Research*, Vol. 37, pp. 220-230.

Fogg, B.J. (2003), *Persuasive Technology*, Morgan Kaufmann Publishers, San Francisco, CA.

Fox, J.E. and Boehm-Davis, D.A. (1998), "Effects of age and congestion information accuracy of advanced traveler information systems on user trust and compliance", *Transportation Research Record*, Vol. 1621, pp. 43-49.

Gefen, D. and Straub, D. (1997), "Gender difference in the perception and use of e-mail: An extension to the technology acceptance model", *MIS Quarterly*, Vol. 21 No. 4, pp. 389-400.

Gitelson, R.J., and Crompton, J.L. (1983), "The planning horizons and sources of information used by pleasure vacationers", *Journal of Travel Research*, Vol. 21 Winter, pp. 2-7.

Goldsmith, R.E. and Hofacker, C.F. (1991), "Measuring consumer innovativeness", *Journal of the Academy of Marketing Science*, Vol. 19 No. 3, pp. 209-221.

Grabler, K. and Zins, A.H. (2002), "Vacation trip decision styles as basis for an automated recommendation system: Lessons from observational studies", Wöber, K., Frew, A., and Hitz, M. (Eds.), *Information and Communication Technologies in Tourism 2002*, Springer Verlag, Vienna, Austria, pp. 458-469.

Gretzel, U., Hwang, Y., and Fesenmaier, D.R. (2006), "A behavioral framework for travel destination recommendation systems design" Fesenmaier, D., Werthner, H., and Wöber, K. (Eds.), *Destination Recommendation Systems: Behavioral Foundations and Applications*, CAB International, Cambridge, MA, pp. 53-64.

Gretzel, U., Mitsche, N., Hwang, Y-H., and Fesenmaier, D.R. (2004), "Tell me who you are and i will tell you where to go: Use of travel personalities in destination recommendation systems", *Information Technology & Tourism*, Vol. 7 No. 1, pp. 3-12.

Griffith, D.A., and Albanese, P.J. (1996), "An examination of Plog's psychographic travel model within a student population", *Journal of Travel Research*, Vol. 34 No. 4, pp. 47-51.

Häubl, G., and Murray, K.B. (2003), "Preference construction and persistence in digital marketplaces: The role of electronic recommendation agents", *Journal of Consumer Psychology*, Vol. 13 No. 1/2, pp. 75-91.

Häubl, G., and Trifts, V. (2000), "Consumer decision making in online shopping environments: The effects of interactive decision aids", *Marketing Science*, Vol. 19 No. 1, pp. 4-21.

Hay, B., Wets, G., and Vanhoof, K. (2003), "Segmentation of visiting patterns on Web sites using a sequence alignment method", *Journal of Retailing and Consumer Services*, Vol. 10 No. 3, pp. 145-153.

Henry, P. (2005), "Is the Internet empowering consumers to make better decisions, or strengthening marketers' potential to persuade?" Haugtvedt, C.P., Machleit, K.A., and Yalch, R.F., *Online Consumer Psychology*, Lawrence Erlbaum Associates, Mahwah, NJ, pp. 345-360.

Hoffman, D.L., and Novak, T.P. (1996), "Marketing in hypermedia computer-mediated environments: Conceptual foundations", *Journal of Marketing*, Vol. 60 July, pp. 50-68.

Hruschka, H., and Mazanec, J. (1990), "Computer-Assisted Travel Counseling", *Annals of Tourism Research*, Vol. 17, pp. 208-227.

Hunt, R.G., Krzystofiak, F.J., Meindl, J.R., and Yousry, A.M. (1989), " Cognitive style and decision making", *Organizational Behavior and Human Decision Processes*, Vol. 44, pp. 436-453.

Hwang, Y.-H., Gretzel, U., and Fesenmaier, D.R. (2002), "Multi-city pleasure trip patterns: An analysis of international travelers to the U.S.", Wöber, K. (Ed.). *City Tourism 2002,* Springer Verlag,Vienna, Austria, pp. 53-62.

Hwang, Y.–H., Xiang, Z., Gretzel, U. and Fesenmaier, D.R. (2009), "Assessing structure in travel queries", *Anatolia,* Vol. 20 No. 1, pp. 223-235.

Jamrozy, U., Backman, S., and Backman, K. (1996), "Involvement and opinion leadership in tourism", *Annals of Tourism Research*, Vol. 23, pp. 908-924.

Jeng, J., and Fesenmaier, D.R. (2002). "Conceptualizing the travel decision-making hierarchy: A review of recent developments", *Tourism Analysis*, Vol. 7, pp. 15-32.

Kerstetter, D., and Cho, M.-H. (2004), "Prior knowledge, credibility and information search", *Annals of Tourism Research*, Vol. 31 No. 4, pp. 961-985.

Kim, S., and Fesenmaier, D.R. (1990). "Evaluating spatial structure effects in recreational travel", *Leisure Sciences*, Vol. 12, pp. 367-381.

Komiak, S.Y.X., and Benbasat, I. (2006), "The effects of personalization and familiarity on trust and adoption of recommendation agents", *MIS Quarterly*, Vol. 30 No. 4, pp. 941-960.

Kramer, R., Modsching, M., ten Hagen, K., and Gretzel, U. (2006), "A field trial to elicit individual preferences in the context of a mobile dynamic tour guide", Hitz, M. Sigala, M., and Murphy, J. (Eds.), *Information and Communication Technologies in Tourism 2006*, Springer Verlag, Vienna, Austria, pp. 100-111.

Kramer, R., Modsching, M., ten Hagen, K., and Gretzel, U. (2007), "Behavioral impacts of mobile tour guides", Hitz, M. Sigala, M., and Murphy, J. (Eds.), *Information and Communication Technologies in Tourism 2007*, Springer Verlag, Vienna, Austria, pp. 109-118.

Liu, B. (2007), *Web Data Mining-Exploring Hyperlinks, Contents, and Usage Data*, Springer Series on Data-Centric Systems and Applications, Springer Verlag, Vienna, Austria.

Lo, L. (1992), "Destination interdependence and the competing-destinations model", *Environment and Planning A*, Vol. 24, pp. 1191-1204.

Loban, S. (1997), "A framework for computer-assisted travel counseling", *Annals of Tourism Research*, Vol. 24 No. 4, pp. 813–831.

Lue, C.C., Crompton, J.L., and Fesenmaier, D.R. (1993), "Conceptualization of multi-destination pleasure trip decisions", *Annals of Tourism Research*, Vol. 20, pp. 289-301.

Madrigal, R. (1995), "Personal values, traveler personality type, and leisure travel style", *Journal of Leisure Research*, Vol. 27 No. 2, pp. 125-142.

Madrigal, R., and Kahle, L.R. (1994), "Predicting vacation activity preferences on the basis of value-system segmentation." *Journal of Travel Research*, Vol. 32 Winter, pp. 22-28.

Manfredo, M.J. (1989), "An investigation of the basis for external information search in recreation and tourism", *Leisure Sciences*, Vol. 11, pp. 29-45.

Markellou, P., Rigou, M., and Sirmakessis, S. (2005), "Web personalization for e-marketing intelligence", Krishnamurthy, S. (Ed.), *Contemporary Research in E-Marketing*, Idea Group Publishing, Hershey, PA, pp. 48-68.

Mayo, E., and Jarvis, P.L. (1981), *The psychology of leisure travel*, CBI Publishing Company, Inc., Boston, MA.

Mazanec, J.A. (2000), "Market segmentation", Jafari J. (Ed.), *Encyclopedia of Tourism*, Routledge, London.

Mazanec, J.A. (2002), "Introducing learning and adaptivity into web-based recommender systems for tourism and leisure services", *Tourism Review*, Vol. 57 No. 4, pp. 8-14.

Mazanec, J.A. (2006), "Building adaptive systems: A neural net approach", Fesenmaier, D.R., Werthner, H., and Wöber, K. (Eds.), *Destination Recommendation Systems: Behavioural Foundations and Applications*, CABI, Cambridge, MA, pp. 137-170.

McKenna, R. (2000), "Marketing in an age of diversity", Gilmore, J.H., and Pine, B.J. (Eds), *Markets of One*, Harvard Business School Press, Boston, MA, pp. 17-34..

McKercher, R. (1998), "The effect of market access on destination choice", *Journal of Travel Research*, Vol. 37, pp. 39-47.

Moon, Y. (2002), "Personalization and personality: Some effects of customizing message style based on consumer personality", *Journal of Consumer Psychology*, Vol. 12 No. 4, pp. 313-326.

Moorthy, S., Ratchford, B., and Talukdar, D. (1997), "Consumer information search revisited: Theory and empirical analysis", *Journal of Consumer Research*, Vol. 23, pp. 263-277.

Murphy, R. (1994), "The effects of task characteristics on covariation assessment: The impact of accountability and judgment frame", *Organizational Behavior and Human Decision Processes*, Vol. 60, pp. 139-155.

Murray, K. (1991), "A test of services marketing theory: Consumer information acquisition activities", *Journal of Marketing*, Vol. 55, pp. 10-25.

Nass, C. and Moon, Y. (2000), "Machines and mindlessness: Social responses to computers", *Journal of Social Issues*, Vol. 56 No. 1, pp. 81-103.

Nass, C., Steuer, J.S., and Tauber, E. (1994), "Computers are social actors", *Proceedings of the CHI Conference*, Boston, MA, pp. 72-77.

Nguyen, Q.N., Cavada, D. and Ricci, F. (2004), "On-tour interactive travel recommendations", Frew, A. (Ed.). *Information and Communication Technologies in Tourism 2004*, Springer, Vienna, Austria, pp. 259-270..

Oppermann, M. (1992), "Intranational tourist flows in Malaysia", *Annals of Tourism Research*, Vol. 19, pp. 482-500.

Pan, B., and Fesenmaier, D.R. (2002), "Semantics of online tourism and travel information search on the Internet: A preliminary study", Wöber, K., Frew, A., and Hitz, M. (Eds.). *Information and Communication Technologies in Tourism 2002*, Springer, Vienna, Austria, pp. 320-328.

Pan, B., and Fesenmaier, D.R. (2006), "Online information search: Vacation planning process", *Annals of Tourism Research*, Vol. 33 No. 3, pp. 809-832.

Park, W.C., Gardner, M.P., and Thukral, V.K. (1988), "Self-perceived knowledge: Some effects on information processing for a choice task", *American Journal of Psychology*, Vol. 101, pp. 401-424.

Park, Y. (2007), *Investigating Online Decision Making Styles*. Unpublished Dissertation. Texas A&M University, College Station, TX.

Pennington-Gray, L., and Vogt, C. (2003), "Examining welcome center visitors' travel and information behaviors: Does location of centers or residency matter?", *Journal of Travel Research*, Vol. 41 No. 3, pp. 272-280.

Perdue, R.P. (1993), "External information search in marine recreational fishing", *Leisure Sciences*, Vol. 15, pp. 169-187.

Pierrakos, D., Paliouras, G., Papatheodorou, C. and Spyropoulos, C.D. (2003), "Web usage mining as a tool for personalization: A survey", *User Modeling and User – Adapted Interaction*, Vol. 13 No. 4, pp. 311-372.

Plog, S.C. (1994), "Developing and using psychographics in tourism research", Ritchie, J.R.B., and Goeldner, C.R. (Eds.), *Travel, tourism and hospitality research: A handbook for managers and researchers* (2nd ed.), John Wiley & Sons, New York, pp. 209-218.

Poon, A. (1993), *Tourism, Technology and Competitive Strategies*, CAB International, Wallingford.

Punj, G., and Staelin, R. (1983), "Central and peripheral routes to advertising effectiveness", *Journal of Consumer Research*, Vol. 9, pp. 366-380.

Reid, I.S., and Crompton, J.L. (1993), "A taxonomy of leisure purchase decision paradigms based on level of involvement", *Journal of Leisure Research*, Vol. 25 No. 2, pp. 182-202.

Ricci, F. (2002), "Travel recommendation systems", *IEEE Intelligent Systems*, Vol. 17 No. 6, pp. 55-57.

Roehl, W.S., and Fesenmaier, D.R. (1992), "Risk perception and pleasure travel: An exploratory analysis", *Journal of Travel Research*, Vol. 30 No. 4, pp. 17-26.

Rosen, D.E., and Purinton, P. (2004), "Web site design: Viewing the Web as a cognitive landscape", *Journal of Business Research*, Vol. 57, pp. 787-794.

Ross, G.F. (1994), *The psychology of tourism*. Hospitality Press, Melbourne.

Rumetshofer, H., Pühretmair, F., and Wöß, W. (2003), "Individual information presentation based on cognitive styles for tourism information systems", Frew, A.J., Hitz, M., and O'Connor, P. (Eds.), *Information and Communication Technologies in Tourism 2003*, Springer, Vienna, Austria, pp. 440-447.

Schafer, J.B., Konstan, J., and Riedl, J. (2001), "E-commerce recommendation applications", *Data Mining and Knowledge Discovery*, Vol. 5 No. 1/2, pp. 115-153.

Scott, S.G., and Bruce, R.A. (1995), "Decision-making style: The development and assessment of a new measure", *Educational and Psychological Measurement*, Vol. 55 No. 5, pp. 818-831.

Shavitt, S., and Brock, T.C. (1994), *Persuasion: Psychological Insights and Perspectives*, Allyn and Bacon, Needham Heights, MA.

Silverman, B., Bachann, M., and Al-Akharas, K. (2001), "Implications of buyer decision theory for design of e-commerce websites", *International Journal of Human-Computer Studies*, Vol. 55, pp. 815-844.

Simonson, I. (2005), "Determinants of customers' responses to customized offers: Conceptual framework and research propositions", *Journal of Marketing*, Vol. 69 January, pp. 32-45.

Snepenger, D., Meged, K., Snelling, M., and Worrall, K. (1990), "Information search strategies by destination-naive tourists", *Journal of Travel Research*, Vol. 29, pp. 13-16.

Spiekermann, S., and Paraschiv, C. (2002), "Motivating human-agent interaction: Transferring insights from behavioral marketing to interface design", *Electronic Commerce Research*, Vol. 2, pp. 255-285.

Sproles, G.B., and Kendall, E. (1986), "A methodology for profiling consumers' decision-making styles", *The Journal of Consumer Affairs*, Vol. 20 No. 2, pp. 268-279.

Swearingen, K., and Sinha, R. (2001), "Beyond algorithms: An HCI perspective on recommender systems", 2001 Workshop on Recommender Systems, available at: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.23.9764&rep=rep1&type=pdf (accessed 29 July 2010).

Tideswell, C., and Faulkner, W. (1999), "Multidestination travel patterns of international visitors to Queensland", *Journal of Travel Research*, Vol. 37, pp. 364-374.

Um, S., and Crompton, J.L. (1990), "Attitude determinants in tourism destination choice" *Annals of Tourism Research*, Vol. 17, pp. 432-448.

Um, S., and Crompton, J.L. (1991), "Development of pleasure travel attitude dimensions", *Annals of Tourism Research*, Vol. 18, pp. 374-378.

Vanhof, K., and Molderez, I. (1994), "An advice system for travel agents", Schertler, W., et al. (Eds.), *Information and Communication Technologies in Tourism 1994*, Springer, Vienna, Austria, pp. 126-132.

Van Raaij, W.F. (1986), "Consumer research on tourism: Mental and behavioral constructs", *Annals of Tourism Research*, Vol. 13, pp. 1-9.

Vogt, C.A., and Fesenmaier, D.R. (1998), "Expanding the functional information search model", *Annals of Tourism Research*, Vol. 25 No. 3, pp. 551-578.

Werthner, H., and Ricci, F. (2004), "E-commerce and tourism", *Communications of the ACM*, Vol. 47 No. 12, pp. 101-105.

Woodside, A.G., and Lysonski, S. (1989), "A general model of traveler destination choice", *Journal of Travel Research*, Vol. 27, pp. 8-14.

Woodside, A.G., and MacDonald, R. (1994), "General system framework of customer choice processes of tourism services", Gasser, R.V., and Weiermair, K. (Eds.), *Spoilt for choice. Decision making processes and preference change of tourist: Intertemporal and intercountry perspectives*, Kulturverlag, Thaur, Germany, pp. 30-59.

Woodside, A.G., and Ronkainen, I.A. (1980), "Vacation planning segments: Self planning vs. users of motor club and travel agents", *Annals of Tourism Research*, Vol. 7, pp. 385-393.

Yang, C. and Wu, C.C. (2006), "Gender differences in online shoppers' decision-making styles", Ascenso J., Vasiu L., Belo C. and Saramago, M. (Eds.), *e-Business and Telecommunication Networks*, Spinger-Verlag, Vienna, Austria, pp. 99-106.

Yoo, K.-H. and Gretzel, U. (2011), "Creating more credible recommender systems: The influence of source characteristics on recommender system evaluations", Kantor, P.B., Ricci, F., Rokach, L., and Shapira, B. (Eds.), *Recommender Systems Handbook*, Springer-Verlag, Vienna, Austria pp. 455-478.

Zarikas, V., Papatzanis, G., and Stephanidis, C. (2001), "An architecture for a self-adapting information system for tourists", *Workshop on Multiple User Interfaces over the Internet: Engineering and Application Trends*, HCI-IHM'2001, September 10-14, Lille, France.

Zins, A. (1998), "Leisure traveler choice models of theme hotels using psychographics", *Journal of Travel Research*, Vol. 36 No. 4, pp. 3-15.

Zins, A. (1999), "Destination portfolios using a European vacation style typology", *Journal of Travel and Tourism Marketing*, Vol. 8 No. 1, pp. 1-23.

Zins, A. (2003), "Adapting to cognitive styles to improve the usability of travel recommendation systems", Frew, A.J., Hitz, M., and O'Connor, P. (Eds.), *Information and Communication Technologies in Tourism 2003*, Springer, Vienna, Austria, pp. 289-297.

Zins A. (2008), "Market segmentation in tourism: A critical review of 20 years' research effort". Kronenberg C., Müller S., Peters M., Pikkemaat B., and Weiermair K. (Eds.), *Change Management in Tourism: From 'Old' To 'New' Tourism*, Erich Schmidt Verlag, Berlin, Germany, pp.289-301..

Figure 1. Framework for Destination Recommender Systems
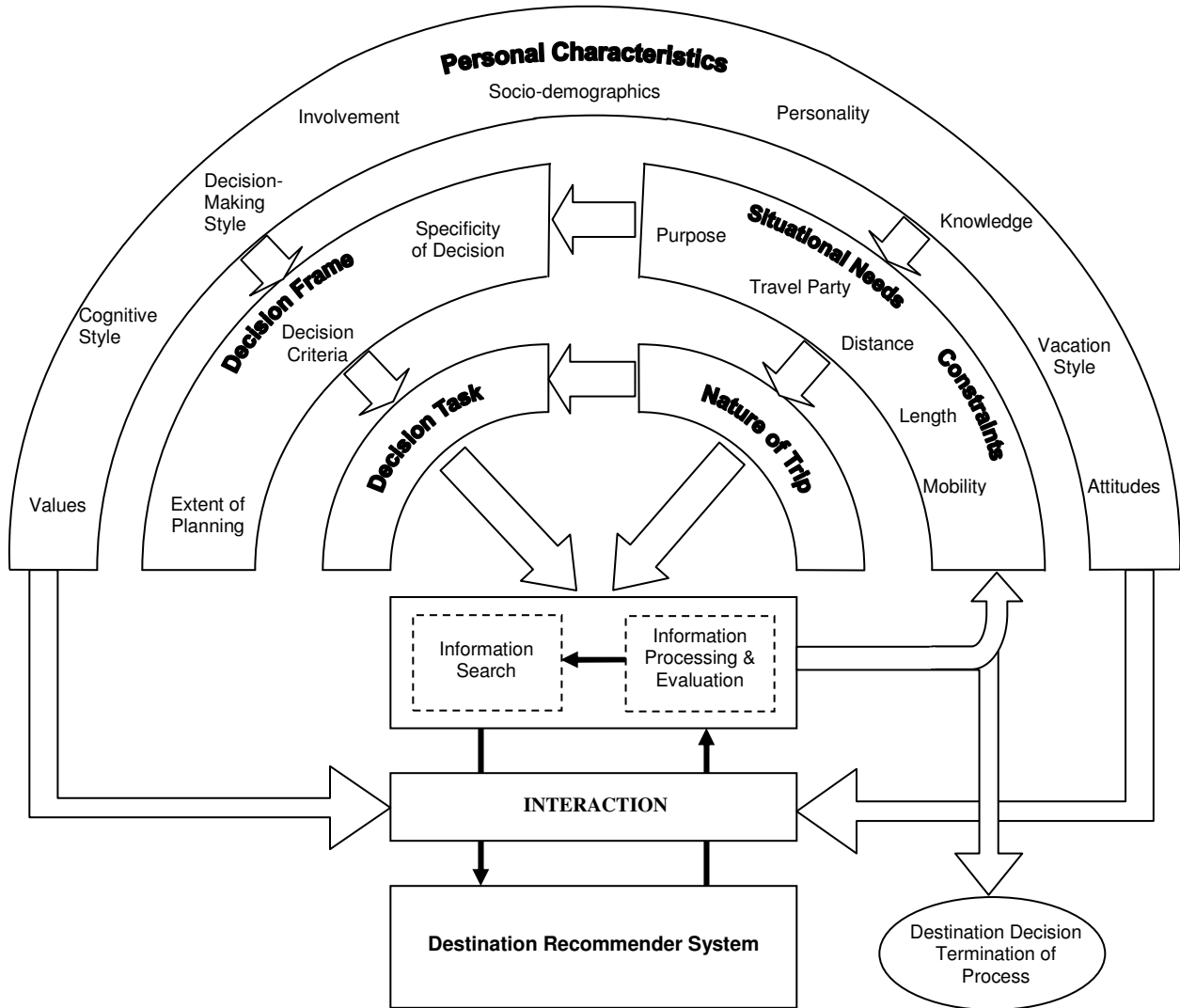
Adapted from Gretzel, Hwang and Fesenmaier, 2006.

Figure 2. Design Components of Destination Recommender Systems

Destination Recommender Systems Design			
Content	Structure	System Intelligence	Experience