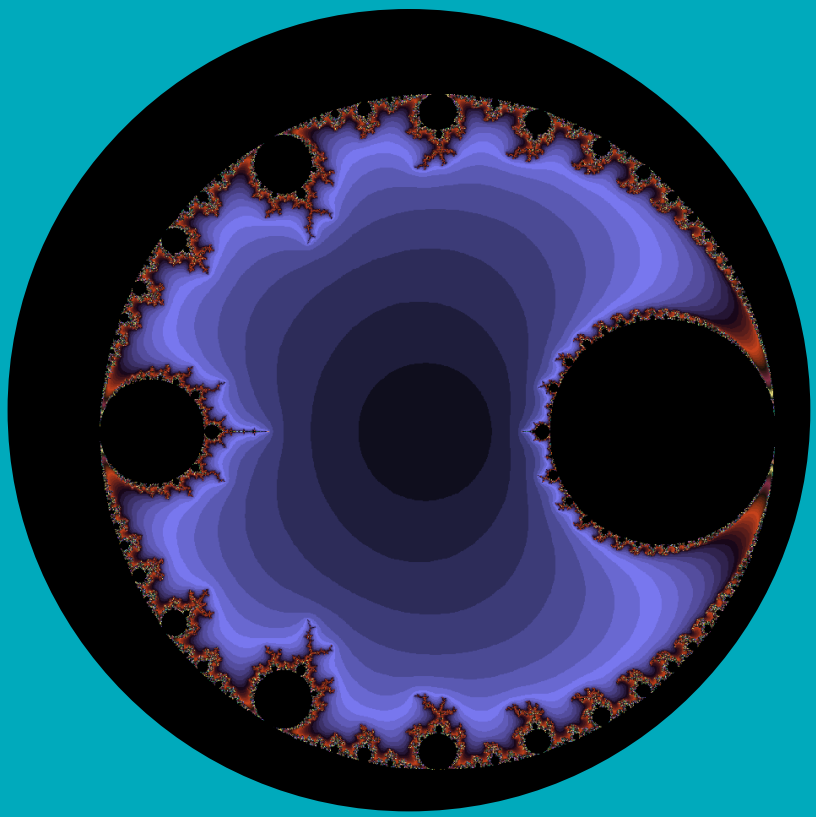
Department of Information and Service Economy

Uncertainty in Consumer Online Search and Purchase Decision Making

Theresa Lauraéus



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Abstract

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Abstract

Consumers´ online pre-purchase information search is an essential part of their buying and decision-making process. Pre-purchase search is an activity that most consumers engage in frequently to extract up-to-date information for a purchase decision. Search is an interesting topic from the practical and academic point of view. We approach the topic by observing the information needs through the concept of uncertainty.

Uncertainty has been identified as a major determinant shaping consumer search and buying behaviour. The ubiquity of uncertainty in everyday choices is reflected in its prevalence in economic theories. Despite the acknowledged importance of uncertainty, however, the actual content of the concept is far from clear, for uncertainty has rarely been the focus of research.

The empirical study of this dissertation focuses on uncertainty in consumer online search and buying behavior, and uncertainty in the decision making process. Firstly, we link consumer online purchasing process into a search theory base, uncertainty and the general decision making literature. Secondly, we will study the validity and the structural relationship of the uncertainty constructs and consumer pre-purchase search strategies. The combined effects of search strategy and uncertainty on consumer buying process effectiveness will be studied. Thirdly, our study is aimed at developing and validating an instrument to measure consumer uncertainty in different decision making phases. Measurement scales for the four dimensions of uncertainty were developed and tested for reliability and validity by studying the uncertainty constructs via extended decision making phases described by Simon. Further, the role of uncertainty is tested in consumer decision making. We will take a look at external search determinants influence on uncertainty. Finally, we test the effect of various concepts of uncertainty on consumer perceived satisfaction of purchase.

In this dissertation, our findings support earlier observations about the aforementioned uncertainties markedly influencing the consumer search behavior, yet, we found them affecting search differently than has been previously reported. We chart the dimensions of uncertainty in consumer decisions by applying the generalized model of decision making put forth by Herbert Simon. We propose that uncertainty has four dimensions in consumer decision context: knowledge uncertainty, evaluation uncertainty, choice uncertainty, and implementation uncertainty. Against previous wisdom, evaluation and implementation uncertainties seem to exercise stronger impact on consumer decisions than the other varieties of uncertainty in electronic commerce context.

Keywords Purchase decision making, uncertainty, knowledge uncertainty, evaluation uncertainty, choice uncertainty, implementation uncertainty, consumer online search process, simultaneous search, sequential search, iterative search, satisfaction

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Essay 3:
Korhonen Pekka, Lauraéus Theresa, Saarinen Timo, and Öörni Anssi. Uncertainty in Consumer Decisions. Aalto University School of Economics. Department of Information and Service Economy.

Essay 4:
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Essay 5:
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Helsinki, October 2011
Theresa Lauraéus

Contents

List of Figures

List of Tables

PART I: Overview of the Dissertation

The first part of the dissertation introduces the research theory and provides an overview of the implementation of the study. The second part of the dissertation introduces the original essays.

1. Introduction

This dissertation discusses linking consumer online search behavior, decision making and uncertainty in case of consumer online purchase.

While pre-purchase search has received considerable academic attention during the decades it is still a high priority topic and even gaining in importance recently for increasing internet penetration dramatically expands many markets and allows consumers to change their information search behavior. Consumer information search has been the focus of numerous articles in the consumer behavior, economics, and marketing literature over the past three decades (Jansen et al. 2006, Spink et al. 2006, Klein and Ford 2003, Moorthy et al. 1997,Beatty and Smith 1987, Punj and Staelin 1983). In recent decades, there have been many investigations into consumer search behavior in a digital environment (for example Spink, Park and Jansen 2006, Biswas 2004, Wu et al.2004, Johnson et al.2004, Klein and Ford 2003, Öörni 2003, Spink et al. 2002, Brynjolfsson and Smith 2000, Alba and Hutchinson 1997, Bakos 1997, Moorthy et al. 1997, Schmidt and Spreng 1996, Brucks 1985).

In the past few years, there have been many interesting studies in topics of online comparison shopping behaviour (Chatterjee and Yawei 2010), simultaneous search behaviour (Chade and Smith 2006) and the effects of consumer search in case of multiproduct competitive market environment (Cachon et al. 2008).

In the other hand, there have been investigations of the opposite side of consumers; firms use brand positioning strategy in search engine marketing (Dou et al 2010) or study the external market-driven determinants of internet pre-purchase information search (Rose and Samuel 2009, Mourali et al. 2005). Household penetration of the internet continues to rise alongside increases in retail websites (Kuruzovich et al. 2008, Rose and Samuel 2009) and pick up in-store shopping behaviour (Chatterjee 2010). The quickness of internet as a retail channel has made it cost-efficient for store-based retailers to offer “order online pick up at store” service via their websites (Chatterjee 2010).

The Internet has made enormous amounts of information available to consumers. Search engines have become an essential way and the first choice to seek pre-purchase information for many people. In the electronics market, consumers are able to seek information in many different ways (search agents). They are able to seek more information faster (larger extent of search), for more alternatives (width of search), and attributes of value (depth of search). In these days, a significant body of literature explores online consumer behaviour including pre-purchase information search (Wu and Rangaswamy 2003, Cambell et al. 2005, Wu et al. 2004, Rose and Samuel 2009, Jepsen and Lund 2007, Grant et al. 2007, Chatterjee 2010, Chatterjee and Yawei 2010).

Consumers face many buying decisions regularly. “Good” decisions, whatever they may be, require information about alternatives and the ability to compare them in a given context. In the past research, there have been studies to build a rational integrative model of online consumer decision making (Patwardhan and Ramaprasad 2005, Mehta et al. 2005) and investigations of consumer decision making on online shopping environments (Häubl and Trifts 2000). In real life, information that is available to consumers is normally incomplete leading to uncertainty about the “right” choice. This motivates consumers to search for more and better information resulting in a better comparison of alternatives, and hopefully to better decisions.

Consumer’s online pre-purchase information search is an essential part of consumer decision making process. Consumer search is the main method, besides advertising, for acquiring information necessary to purchase decisions. Consumers look for products and competitive prices in an attempt to make a “right choice” and decide what, when, and from whom to purchase. Consumers make everyday decisions regarding choice, purchase and use of products and services. These decisions are often important to consumers and thus difficult to make. Consumers are often faced with a large number of alternatives and a great deal of information available from many online sources (Patwardhan and Ramaprasad 2005). A typical consumer choice consists of a set of alternatives, each described by several attributes (Bettman, Johnson and Payne 1990). Furthermore, consumers are usually faced with non-comparable information and difficult value trade-offs. Elements such as alternatives, attributes of value, and uncertainty directly affect the difficulty of consumer choice task. Choice difficulty generally increases: Firstly, as the number of alternatives and attributes increases, secondly, if at least one of the attribute values is difficult to process, thirdly, if there is high uncertainty concerning the attribute values, and fourthly, as the number of attributes shared by the

options decrease (Bettman, Luce and Payne 1998, Bettman, Johnson and Payne 1990). This multifaceted nature of the consumer decision-making task has generated a number of important research questions. The difficulty of decisions, and thus choice of decision strategy, is contingent on the elements of the task; the number and qualities of alternatives and attributes as well as time constraints profoundly affect the difficulty of the decision. The difficulty of consumer decisions is also influenced, by the way information is available in many channels like advertisements, brochures, and consumer reports (Häubl and Trifts 2000, Bettman, Johnson and Payne 1990).

The study of consumer choice and decision processes has been an active topic in consumer behavior research for over 30 years (Katona and Mueller 1955, Peter 1979, Howard and Sheth 1969, Bettman 1979). While pre-purchase search has received considerable academic attention during the decades it is still a high priority topic and recently even gaining in importance as increasing internet penetration dramatically expands many markets and allows consumers to change their information search behavior (Wu and Rangaswamy 2003, Cambell et al. 2005, Wu et al. 2004, Rose and Samuel 2009, Jepsen and Lund 2007, Grant et al. 2007, Chatterjee 2010, Alba and Lynch 1997, Bakos 1997, Evans 1997, Öörni 2003).

More than 60 determinants have been found to relate to the amount of pre-purchase consumer searching. In this dissertation, we studied consumer online pre-purchase search behavior through the search strategy they employed: a sequential, simultaneous, or iterative search strategy. We modelled the search strategies in order to understand consumer search behavior more deeply and to analyze it further.

Spink, Park and Jansen (2006) found that many Web searches involved users seeking information on two or more topics concurrently. Overall, Spink et al. (2006) see some users moving towards more complex searches by a minority of users that involve multiple related interactions and multiple topics. Therefore, because of continuous change, it is fruitful to study consumer online search behavior further.

Uncertainty is one of the central concepts in the consumer behavior literature. Past research has demonstated clearly the importance of risk and/or uncertainty avoidance within the buying process (Quintal et al. 2010) and the role of online browsing and prior knowledge on pre-purchase search (Barton and Jikyeong 2005).

What is uncertainty? It captures the lack of the individual's control over how the future is going to unfold. Future events are difficult to foresee mostly because consumer environments are both complex and in constant state of change. Consumers must therefore update their information, and

there is often no better means to do so than through search. In the literature, uncertainty has been established as the motive for consumer search. Uncertainty motivates consumers to search for more and better information resulting in a better comparison of alternatives, and hopefully to better decisions. In electronic markets consumers are able to update their knowledge easier than in conventional markets. The concept of uncertainty provides us with a coherent theoretical framework with which to explore consumer search in electronic markets.

Pre-purchase information search is often seen as a means to lessen decision-related uncertainty. Therefore, keeping other determinants constant, greater uncertainty should lead to more extensive search behavior (Lanzetta 1963). This purchase-related uncertainty has been an active topic for some decades (Stigler 1961, Lanzetta 1963, Lanzetta and Driscoll 1964, Urbany 1986, Urbany, Dickson and Wilkie 1989, Moorthy, Ratchford and Talukdar 1997). Uncertainty is a complex topic, and the proper conceptualization of uncertainty is still disputed. The early studies of uncertainty suggested two types of uncertainties linked to purchase decisions (Lanzetta 1963, Sieber and Lanzetta 1964, Stigler 1961).

In academic literature, uncertainty is a concept that can be used to link electronic markets research to economic, consumer behavior, and decision-making research. There has been research about uncertainty for nearly 40 decades, and some of the most important studies were made in the 1960s by Stigler (1961) and Lanzetta (1963). Despite its prevalence in consumer behavior theories, the concept of uncertainty remains surprisingly vague. Few efforts have been made to address its composition; Urbany et al. (1989) and Moorthy et al. (1997) being among the notable exceptions. Some efforts have been made to resolve the inner structure of uncertainty. Lanzetta (1963) posited that higher levels of uncertainty should lead to more extensive search. Urbany et al. (1989) suggested that at least two dimensions of pre-purchase uncertainty exist and have quite opposite effects on consumer search behavior. However, Urbany et al. (1989) noted that there might be further dimensions to the uncertainty concept. Few efforts have been made to remodel pre-purchase uncertainty since (Barton and Jikyeong 2005, Quintal et al. 2010). There is a need to identify the causes of uncertainty and connect these to effects on consumer behavior. Consumer decision-related uncertainty needs to be defined in a theoretically coherent frame of reference.

What is, however, missing, is a comprehensive framework to tie the various uncertainties firmly to consumer decision making. In the literature there is lack of evidence about the connection between the consumer decision process and uncertainty. Uncertainty has been established as the

motive for consumer search (Simon 1957, Bettman, Johnson and Payne 1990). It is a concept that can be used to link electronic markets research to economic, consumer behavior, and decision-making research, thereby facilitating the creation of a fuller picture of the effects electronic markets may have on consumer behavior (Öörni 2003). The concept of uncertainty provides us with a coherent theoretical frame to explore consumer search in electronic markets. Uncertainty, on the other hand, is also the prime concept linking consumer search and decision-making theories (Simon 1957, Bettman, Johnson and Payne 1990, Newell and Simon 1972). As decision-making is central to consumer search (Simon 1957), it is hoped that uncertainty could be conceptualized further to create a theoretical frame that could be used to analyze any consumer decision-making and purchasing process in the electronic markets. Measuring customers' pre-purchase behavior and decision-related uncertainty helps us understand factors that influence online purchasing and decision making in the electronic environment and, thus helps us to improve electronic services.

We extend the work of Urbany et al. (1989), who identified two dimensions of uncertainty, knowledge uncertainty and choice uncertainty, as possible determining factors of consumer pre-purchase search. Some studies have investigated the connection between uncertainty and search behavior, but still, few attempts have been made to relate uncertainty and consumer search behavior to decision making research.

In this dissertation, we aim to model the structure of uncertainty in consumer decision making. We apply a theoretically coherent framework, the decision process model proposed by Herbert Simon (1957, 67) to identify the salient dimensions of uncertainty and to test their relevance to consumer pre-purchase behavior. We will test what are the major determinants of total uncertainty related to consumers' pre-purchase decision process.

In summary, in this dissertation our main aim is to conceptualize uncertainty further, link consumer search theory to decision making literature, and to develop measurement scales of uncertainty for the four different decision making phases.

Next, we take a look at the structure of this dissertation. Secondly, we describe the research area of this dissertation. Thirdly, we introduce the empirical phases of the study.

1.1 Structure of this dissertation

This study consists of two parts. ***Part 1, overview of the dissertation***, introduces the research area and reviews the relevant literature, and describes the objectives of the study as well as the research methods used. Moreover, it reviews the results from the separate papers. The fifth chapter is dedicated to conclusions and theoretical contribution of this dissertation.

Part 2, Original research papers, consists of the five original research papers presenting the research efforts taken to meet the objectives of this dissertation.

1.2 Research area

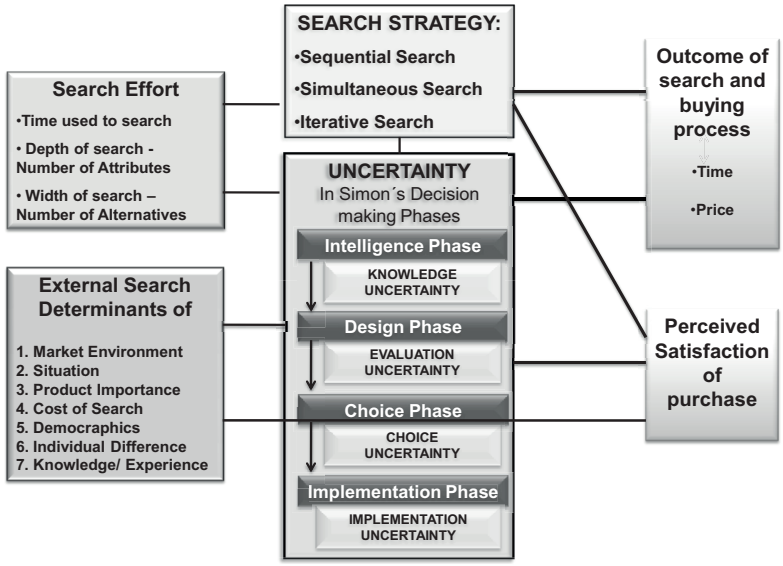

Figure 1: Research area of this dissertation

The research areas consist of (1) the concepts of uncertainty (Knowledge uncertainty, Evaluation uncertainty, Choice uncertainty, and Implementation uncertainty), (2) Search effort (measured by time used to search, depth of search, and width of search), (3) three types of search strategy (simultaneous, sequential, and iterative search strategies), (4) the outcome of search process (measured by time and purchase price), (5) seven categories of external search determinants, and (6) consumer perceived satisfaction of purchase.

1.3 Research objectives

In this dissertation, objectives sit behind the main research question: "How uncertainty affects consumer online search behavior and purchase decision making." This doctoral dissertation includes five essays. Next, I will describe the objectives of each paper.

In the first paper of this dissertation, *"Knowledge and Choice Uncertainty Affect Consumer Search and Buying Behavior",* our objective is to study the validity and the structural relationship of the uncertainty constructs and their effect on pupils pre-purchase search effort in the electronic markets.

In the second paper: *"Relationship between Uncertainty and Patterns of Pre-purchase Consumer Search in Electronic Markets",* our objective is to investigate the combined effect of uncertainty and search process on the outcomes of pupils online purchase.

The third paper, *"Uncertainty in Consumer Decisions"* our objective is to link consumer behavior literature to decision making via uncertainty construct, and develop the measurement scales of uncertainty for the different decision making phases.

In the fourth paper, *"Uncertainty is the other side of the coin of information online search",* my objective is to analyze the influence of external search determinants on uncertainty.

Further, in the fifth paper, *"Impact of Online Pre-purchase Search on Consumer Satisfaction"***,** our objective is to test the combined effect of uncertainty and search process on consumer perceived satisfaction of purchase. In this paper, we link together the concepts of uncertainty with search strategy, external search determinants, and consumer perceived satisfaction of purchase.

1.4 Empirical phases of the study

We modeled consumer information search to search strategies to be able to investigate the uncertainty and the external search determinants influence on consumer search behavior. The empirical study of this dissertation focused on uncertainty in consumer online search and buying behavior and decision making process. This section provides an overview of two phases of empirical research we conducted for this dissertation.

In the first phase of the study, in the pilot study we studied the validity and the structural relationship of the uncertainty constructs and their effect on consumer search processes and pre-purchase search behavior. The effect of individual differences and purchase situations on search behavior is complex, often interactive and difficult to interpret and generalize about. Therefore, we chose as similar and consistent a group as possible for our observation research. Our response group consisted 56 teenagers between 12-15 years of age from the same demographic area. The method we used in this pilot study was empirical observation. We choose this method in order to find out what people really do in a search, purchase and decision making situation, rather than simply asking what they think they would do. The observation research approach was selected in order to expand understanding and to learn more about the phenomenon of uncertainty and consumer search and buying behavior. We conducted observations during May 2004 at their school premises. We used a semi-structured questionnaire and analyzed the data by quantitative methods. In the pilot study, we treated the knowledge and choice uncertainty as the constructs of uncertainty, but the first empirical analyses showed that there was considerable need to separate the uncertainty constructs for the four different phases of decision process. The outcomes from the first phase of the study are the first and second essay of this dissertation.

In the second phase of the study, we aimed to model the structure of consumer decisions related uncertainty from the decision making perspective. We applied a theoretically coherent framework, the decision process model posited by Herbert Simon (1957, 67) in order to identify the salient dimensions of uncertainty and to test for their relevance in consumer pre-purchase behavior. We prepared the questionnaire by the method of measurement developing (Nunnally, Churchill). After years work with the questionnaire, we conducted a mail-survey for the period from May through June 2006. The respondents were obtained by drawing a random sample of 2000 Finnish people. The sample frame was restricted to people over 18 years of age. In the final phase of the measure developing process, we tested our uncertainty measures for reliability, content validity, predictive validity, and construct validity.

Survey research is one of the most important methods available in the social sciences for the collection and measurement of empirical data. It is a method used to gather data from respondents seen as being representative of some population by utilizing an instrument composed of closed

structured or open-ended items. This study utilizes questionnaires with a closed structure, where the latent variable items were drawn from the prior research literature. The outcome of the second phase of the study is third, fourth and fifth essay of this dissertation.

2. Linking Consumer Online Pre-purchase Search, Decision making and Uncertainty

2.1 Consumer pre-purchase search

The external information search construct represents the motivated acquisition of information from the environment (Bettman 1979, Engel et al. 1990) and therefore external search precedes many consumer decisions (Bettman 1979, Punj and Staelin 1983, Beatty and Smith 1987, Newman and Staelin 1971, Schmidt and Spreng 1996). The consumer purchase decision process is usually presented as consisting of three phases: pre-purchase, purchase and post-purchase phases. The pre-purchase phase includes need recognition, information search, evaluation of alternatives and product choice (Nicosia 1968, Duncan and Olshavsky 1982, Engel et al. 1968) and implementing the choice.

Information sources used by the consumers pre-purchase information search is an interesting topic from both the academic and practical point of view. At present, consumers have a number of different sources at their disposal. Conventional sources, such as advertising, newspaper and magazine advertisements, radio and television commercials, and brochures have been complemented during the last decade by information sources implemented using Internet technology. For many people, searching and comparison-shopping on the Internet is increasingly a daily behavior. The Internet has made enormous amounts of information available to consumers. While the total amount of information available to consumers increases the ability to absorb, it remains limited, leaving many consumers at a loss with regard to purchase decisions.

Search is frequently executed in relation to purchases (Howard and Sheth 1969, Kiel and Layton 1981, Klein and Ford 2003, Schmidt and Spreng 1996, Spink et al. 2002, Stigler 1961, Urbany 1986, Urbany, Dickson and Wilkie 1989, Öörni 2003), yet, consumers tend to limit the search to a

handful of products and vendors (Bakos 1997, Öörni 2003), because search takes time and effort, and thus is costly.

The study of consumer choice and decision processes has been an active topic in consumer behavior research for over 50 years (Katona and Mueller 1955, Nicosia 1968, Howard and Sheth 1969, Bettman 1979). While pre-purchase search has received considerable academic attention during the decades it is still a high priority topic and recently even gaining in importance as increasing internet penetration dramatically expands many markets and allows consumers to change their information search behavior.

Consumer information search has been the focus of numerous articles in the consumer behavior, economics, and marketing literature over the past three decades (Beatty and Smith 1987, Moorthy et al. 1997,Punj and Staelin 1983, Klein and Ford 2003). In recent decades, there have been many investigations into consumer search behavior in a digital environment (Chatterjee and Yawei 2010, and Samuel 2009, Chatterjee 2010, Jepsen and Lund 2007, Wu and Rangaswamy 2003, Cambell et al. 2005, Wu et al. 2004, Rose, Grant et al. 2007, Spink et al. 2002, Alba and Hutchinson 1997, Bakos 1997, Biswas 2004, Brucks 1985, Brynjolfsson and Smith 2000, Spink et al. 2006, Johnson et al.2004, Klein and Ford 2003, Moorthy et al. 1997, Schmidt and Spreng 1996, Whinston and Stahl 1997, Wu et al.2004, Öörni 2003) in the context of search attributes (Lynch and Ariely 2000, Klein 1998, Degartu et al. 2000) and media interactivity (Alba and Hutchinson 1997, Klein 1998). Recently, there has been research into internet-based market efficiency (Brynjolfsson and Smith 2000, Öörni 2003, Öörni 2002), price sensitivity (Lynch and Ariely 2000, Degartu et al. 2000) and search costs (Alba and Hutchinson 1997, Bakos 1997, Lynch and Ariely 2000, Hoque and Lochse 1999, Wu et al.2004). There is also much research studying the use of web search engines (Jansen and Pooch 2001, Montgomery and Daulotsis 2001, Spink et al. 2002, Spink, A., Jansen, B.J., Wolfram, D., and Saracevic, T. 2001 and 2002,Spink, A., Jansen, B. J., & Pedersen, J. 2004)

In a digital environment consumer information pre-purchase and search behavior is different from traditional search behavior (Alba and Hutchinson 1997, Bakos 1997, Brynjolfsson and Smith 2000, Degartu et al. 2000, Evans and Wurster 1997, Spink et al. 2002, Öörni 2003, Öörni 2002). Jansen and Pooch 2001 report that internet searchers use different search characteristics to traditional seekers.

Spink et al. (2002) reported the general Web queries are short with most users entering 2-3 term per query and 2-3 queries per search. The extent of search is an important topic since consumer search is one of the most important mechanisms that check market prices. Search is costly and,

hence, consumers may not engage in an extensive search if uncertainty negatively affects their perception of the outcome of the search. These search costs are mostly in terms of the cost of the time spent searching: time is more valuable to the "rich" than for the "poor". "Rich" customers are therefore said to be "high cost," and "poor" customers said to be "low cost". Other things being equal, the former should search less than the latter. According to Alba et al. (1997) the total cost of a search activity are both "monetary and non-monetary expenditure" (Alba and Hutchinson 1997). The monetary cost is dependent on the consumer's income. Hence, different consumers will assign different costs to a search activity irrespective of the absolute financial costs of the search (Punj and Staelin 1983, Urbany 1986). Alba et al. (Alba and Hutchinson 1997) define the non-monetary costs to be in the form of the time, inconvenience and difficulties of carrying out the search activity (Stigler, 1961). In general, for most products we can expect to have lower search costs on the Internet (Alba and Hutchinson 1997, Bakos 1997, Lynch and Ariely 2000). According to Jansen, the sponsored search mechanism is important to finance the search engines ability to offer "free" searches. Search costs are influenced by variables such as a consumer's experience or knowledge (Moorthy et al. 1997) and the uncertainty or perceived risks faced by the consumer (Srinivasan and Ratchford 1991, Urbany 1986).

2.1.1 Offline Versus Online Consumer Pre-purchase search

The exponential growth of usage of the internet and the mobile phones are the most important development in information technology in the last decade. Initially, much of internet based electronic commerce was restricted to online shops and services that were accessible via a web browser. A consumer could search for a specific product using a browser and then purchase it by simply entering a valid credit card number (Iyer and Pazgal 2003). Nowadays, more sophisticated tools for escorting consumers through search, comparison and buying process are common in the internet. Internet shopping agents (ISA) are in everyday use for a large number of consumers. Internet shopping agents allow consumers to search the Internet for a fully specified product and then find where to shop and for what price. Consumers are able to use the tools to help with comparison-shopping. Generally, these agents are only sources of information –consumers must link to the retailer website in order to make a purchase (Iyer and Pazgal 2003). Spink, Jansen, Wolfram, and Saracevic (2002) report a shift in Web search topics from entertainment to commerce, travel, employment, economy, people, places, and things.

Search topics have shifted from entertainment to e-commerce as the content of the Web has shifted more towards business and people searching (Spink, Jansen & Pedersen 2004).

Some studies have researched the difference between offline and online shopping (Degeratu et al 2000, Andrews and Currim 2000). Degeratu et. al showed that for some product categories the brand name is more important online than in a traditional shopping environment, but this might depend on the available attribute information. Andrews and Currim (2000) found that the brand loyalty is lower for online compared to offline shopping, but online shoppers select from a smaller set of brands, thereby remaining loyal to a smaller number of brands A useful way of explaining the role of the brand in the online environment is to use the classification of search and experience attributes used by consumers in the decision making process (Nelson 1974, Iyer and Pazgal 2003). In a traditional environment, consumers are generally able to evaluate the quality of the product prior to the purchase, thus the product can be categorized as a 'search good'. However, if the same product is sold over the internet, the physical product are not present and the product could be classified as an 'experience good' (Alba et al. 1997, Moore and Andradi 1996, Iyer and Pazgal 2003). Therefore, brands are capable to creating additional value in a virtual environment. Conceptually, online shopping favours large brands due to the fact that they provide salient attributes of familiarity, a signal of presence, commitment, and substance (Iyer and Pazgal 2003, Alba et al 1997).

2.1.2 Definitions of Consumer Online Pre-purchase Search

Information search – Consumers look for information about products with desired qualities and the sellers offering these products at competitive prices in an attempt to decide what, when, and from whom to purchase. Consumer's pre-purchase information search is an essential part of the consumer decision making process (Bettman 1979; Bettman et al. 1990; Engel et al. 1990; Howard and Sheth 1969; Olhavsky 1985, Schmidt and Spreng 1996).

Online search behavior – In recent years, there have been many studies into consumer search behavior in a digital environment (Chiang 2006, Jansen et al. 2006, Johnson et al. 2004, Lauraeus-Niinivaara et al. 2007, 2008, Smith and Spreng 1996, Spink et al. 2005, Öörni 2002, 2003). When we are writing about search behavior, we defined the situation wherein consumers are seeking or looking for information about products for purchase decision making purposes. There are nearly 60 factors that have

been found to influence consumer pre-purchase information search behavior (Schmidt and Spreng 1996; Srinivasan and Ratchford 1991, Beatty and Smith 1987).

The external information search construct represents the motivated acquisition of information from the environment (Bettman 1979, Engel et al. 1990).

Electronic markets – Electronic markets are the markets on the internet. Here, the word Electronic market means the same as digital markets, internet markets, virtual markets, or online markets.

Electronic agent search – In a definition provided by Öörni (2003) the characteristics of *electronic agent search* are 1) the information channel is electronic, 2) all the information is retrieved in a single stage 3) no human interaction is required. Product comparison could be more efficient if consumers were able to evaluate available products side by side. This is the essence of simultaneous search, in other words, comparison shopping or agent search. All information needed for the evaluation is readily available, and the consumer has no need to resort to secondary information sources. Thus, there are only two phases in the process: information gathering and the buying decision. Whinston et al. (1997, p. 267) suggest that online search technology may automate the search process and enable consumers to execute more sophisticated and efficient searches.

Search engine – When we are writing about the tools of the internet, a search engine is different than a search agent. We define the internet tools that make information available for different purposes as search engines (Jansen, Spink & Saracevic 2000).

Search agent – The internet tools that make information comparing available for consumers purchase decisions are search agents. Search agents are created to help consumers to make purchase decision most efficiently. Search agents include information of product prices and product qualities in the same internet site. At a search agent site, information is in comparable form (Jansen, Spink & Saracevic 2000).

Width and depth of search – Constructs of width and depth of search are measures of the extensiveness of search. The width of search can be defined as the number of alternatives considered. The depth of search describes how many attributes of a product are evaluated (Whinston et al 1997, Öörni 2003).

2.1.3 The Definitions of Search Patterns

The main search-related cost factor is typically the opportunity cost of the searcher's time. Search costs depend on consumer's ability to search, which impacts the pattern of search that one can adopt. Exhaustive consumer search, or at least a radical increase in the size of the consideration set, could be attained if a simultaneous (agent) search pattern prevailed in the electronic markets (Öörni 2003).

Search patterns – Search pattern refers to the shape of the consumer search process. In other words, a search pattern is the search strategy that the consumer employed, when seeking information for a buying decision (Öörni 2003). Consumers employ different search patterns in their pre-purchase search.

Simultaneous search – Product comparison could be more efficient, if consumers were able to evaluate more the available products side by side. This is the essence of simultaneous search. All information needed for the evaluation is readily available, and a consumer has no need to resort to secondary information sources. Thus, there are only two phases in the consumer decision making process: information gathering and the buying decision. In the electronic markets, simultaneous search is often called agent search, because the internet tools that makes information comparing available are called search agents (Whinston et al. 1997, Öörni 2003).

In offline conditions, a consumer might collect a simultaneous search sample based on either internal information formed by experience of repeated purchases (internal search), or by, for example, acquainting her/himself with special issues of consumer journals that compare the products that the consumer is interested in (external search).

Sequential search – Sequential search occurs when a consumer consecutively visits or contacts sellers. Each visit is composed of an information gathering and a buying decision phase. The consumer familiarizes her/himself with the products available and decides whether to purchase a product or to visit the next store. The consumer can compare the products in various stores, yet s/he has to resort to her/his memory as a source of product information to evaluate those products not found in the current store (Whinston et al. 1997, Öörni 2003).

Iterative search – The iterative search begins simply as a sequential query of product information. The query results are compared to each other, and then outputs or results are reported or at least noted. The difference to a sequential search is that after finding the outputs, a consumer will make the query again, and the process is then repeated. The possibility to return to price / product information that was previously searched, but not chosen,

can be called an iterative search. An iterative search allows back-and-forth-movement as consumers compare product and service offerings.

Definitions for classification of iterative web search engine queries: *Generalization:* the current query is on the same topic as the searcher´s previous query, but the searcher is now seeking more general information (Jansen, Spink and Kathuria 2006).

Hierarchical: The current query is on the same topic as the searcher´s previous query, but searcher is looking for subject related to the previous topic by some hierarchy (Jansen, Spink and Kathuria 2006).

Parallel: the current query is on the same topic as the searcher´s previous query, but the searcher is looking for other related information (Jansen, Spink and Kathuria 2006).

Reformulation: The current query is on the same topic as the searcher´s previous query, but searcher reformulated the query in some manner (Jansen, Spink and Kathuria 2006).

Specialization: The current query is on the same topic as the searcher´s previous query, but the searcher is now seeking more specific information (Jansen, Spink and Kathuria 2006).

2.1.4 Measurements of consumer information search

We used the same measures of search behavior as those described by Urbany et al. (1989) that are based on Kiel and Layton´s (1981) study. The measures of actual shopping time, number of brands considered, and number of stores shopped at are nearly identical to the measures reflected in Kiel & Layton´s retail search factors. While the number of sellers visited is the measure with the best theoretical grounding (Stigler 1961), it has often been found wanting as a measure of total shopping effort. In observation research, the respondents were also measured with regard to the real number of different stores at which they shopped, the number of alternatives they considered, and the various sources of information they used.

Constructs of width and depth of search are measures of the extensiveness of search. The width of search can be defined as the number of alternatives considered. The depth of search describes how many attributes of a product are evaluated. The efficiency of search is measured by the time used to search, and the price of the outcome.

2.1.5 The External Search Determinants

Consumer's pre-purchase information search is an essential part of the consumer decision making process (Bettman 1979; Bettman, Johnson and Payne 1991; Engel, Blackwell and Miniard 1993; Howard and Sheth 1969; Olhavsky 1985, Schmidt and Spreng 1996). There have been three major theoretical streams of consumer information search literature: the psychological/motivational approach, the economics approach, and the consumer information processing approach (Schmidt and Spreng 1996; Srinivasan 1990).

There are nearly 60 factors that have found to have an influence on consumer pre-purchase information search (Schmidt and Spreng 1996; Srinivasan and Ratchford 1991). According to Srinivasan and Rachford (1991), these factors can be divided into three dimensions: Environmental factors, situational factors, and factors of consumer characteristics.

In the past decades, some researchers have modeled the relationships among these 60 or so factors influencing consumer search behavior (Kulviwat, Guo and Enghanil 2004; Schmidt and Spreng 1996; Srinivasan and Ratchford 1991, Maute and Forrester 1991; Beatty and Smith 1987, Punj and Staelin 1983, Moore and Lehmann 1980). Schmidt and Spreng 1996 provided a theoretically based model, and a set of four factors that mediate the effects of 20 factors of external search (Schmidt and Spreng 1996). Those four factors are based on two theoretical perspectives of external information search: the psychological and information processing perspective, and the economics approach (Schmidt and Spreng 1996).

We based our study on Beatty and Smith´s (1987) research of external search determinants. They base their study on Moore and Lehmann´s (1980) classification of search determinants. The original classification is taken from Bettman (1979) and Newman (1977). Giving consideration to our research question, we choose Beatty and Smith´s model for our framework. It provides us with the clearest classification of the information search variables. Their model is comprehensive and based on large literature review.

Beatty and Smith´s model is divided into seven groups. There are market environmental variables, situational, product importance and cost of search variables, demographic, individual difference and knowledge variables. Our aim in the third paper was to find out how consumer information search variables are related to consumer perceived uncertainty in online purchases. Beatty and Smith (1987) identified the relationship between the antecedent and search as positive (+), negative (-), or no relationship (0) and listed the nature of the product category. They found that consumers

search more if the purchase is expensive, more visible or a complex product. They also found that consumer search more for products that include “greater perceived risk” and that individual factors effect search. They took the examples of perceived benefits of search, demographic location, and product knowledge as individual factors. They further found that factors in the marketplace and buying situation have an effect on pre-purchase consumer information search.

2.2 Consumer decisions

2.2.1 The difficulty of consumer decisions

The difficulty of decisions and, thus choice of decision strategy is contingent upon the elements of the task: Firstly, the number of brands, and secondly, the qualities of alternatives and attributes, as well as, thirdly, time constraints, profoundly affect the difficulty of the decision. Increased time constraints have been found to lead to the decision-maker to simplify the task at hand (Wright 1980), to accelerate the information processing (Zur and Breznis 1981) to selectively focus on information (March 1978), and to change the decision strategy employed (Payne, Bettman and Johnson 1988). Likewise, an increase in the number of alternatives may lead consumers to simplify their information processing. The number of alternatives as well as the time constraints and task characteristics do not depend on the information content of product attributes. Task characteristics, on the other hand, are related to the set of alternatives included in the decision problem. For example, Tversky et al. (1990) have shown that inclusion of a new alternative in the decision may reverse the prior preferences with regard to other options.

The difficulty of consumer decisions is influenced by both the elements of the task and by how information is provided in the environment (Bettman, johnson and Payne 1990). Information is often available from many channels, like advertisements, brochures, and consumer reports. These sources diverge on the amount and quality of information displayed. Advertisements, for example, typically highlight the strong points of the product while the weaknesses are not discussed. The amount and the quality of information have a strong impact on the consumers’ ability to choose. While fairly complete information on multiple choices promote attribute-based decision strategies, low quality or missing information may force consumers to make inferences and possibly to resort to decision

strategies that require less complete information, like brand-based choice (Dou et al. 2010). A high amount and quality of information are related to decision quality. Attribute-based choices, involving fairly complete and detailed information, lead to more precise decisions, although they require more processing capacity and effort than brand-based strategies (Dou et al. 2010).

The organization of information affects the difficulty of consumer choice. In advertisements, for example, product information is typically displayed one brand at a time, and only a subset of attribute information relevant to choice is revealed. Consumers are effectively forced to retrieve information sequentially rather than simultaneously, which results in some decision strategies becoming very difficult (Bettman 1982). If information content is changed constantly, it will effectively amount to an increase in mental effort, less accurate decision strategies, and lower quality decisions.

Human cognitive abilities have often been found to lack in comparison with the real-life problems people confront (Simon 1982). Nowadays, there are helping tools for example "the Deep Search" tool, which acts like a very fast librarian, that are able to pick up and sort books and articles almost instantly according to several different classification criteria, thus, making information access and retrieval vastly simpler, quicker, and more rewarding (Shepherd 2007). In the future, many of us will probably be using "the Deep Web" tool or "the Hidden Web" tool, which comprises such resources as images, video, audio and other content for decision-making. Still, despite the helping tools, human cognitive abilities, in general, are wanting. Decision makers are required to perceive, process, and evaluate the probabilities of uncertain events. There is evidence of decision makers possessing serious biasing heuristics for probability estimation (Wright 1980). Rather than simply accepting that humans are poor estimators of probability, information processing limitations should be understood.

2.2.2 Consumer decision behavior

Two concepts are central to the characterization: search and satisficing (Simon 1957). In Administrative Behavior (Simon 1979), rationality is bounded when there are failures of knowing all the alternatives, uncertainty about relevant exogenous events, and inability to calculate consequences (Simon 1979).

If the alternatives for choice are not given, then the decision maker must search for them. Hence, a theory of bounded rationality must incorporate a theory of search. This idea was developed by Stigler as an example of a decision regarding the purchase of a second-hand automobile. When a

consumer has an alternative choice meeting his level of aspiration, he would terminate the search and choose that alternative (Simon 1957). Simon called this mode of selection satisficing (Simon 1957). It had its roots in the empirically based psychological theories of aspiration levels. Aspiration levels are not static, but tend to rise and fall with changing experiences. In an environment that provides many good alternatives, aspirations rise; in a "poor" environment, they fall (Simon 1957). The important thing about the search and satisficing theory is that it showed how choice could actually be made with reasonable amounts of calculation, and using very incomplete information, without the need for carrying out this optimizing procedure (Simon 1979).

In earlier decades, there have been studies to test whether people behave as statistical decision theory suggests and, many psychological studies to uncover the processes of human decision making and problem solving (Newell and Simon 1972, Simon 1979). There have also been numerous studies of the actual processes of decision making in organizational and business contexts. Furthermore, there have been reformulations and extensions of the theory of decision making (Simon 1979).

The axiomatization of utility and probability after World War II, and the revival of Bayesian statistics, opened a research area for testing empirically whether people behaved in choice situations so as to maximize subjective expected utility (SEU) (Simon 1979). Kahneman and Tversky (1979) showed that under one set of circumstances, decision makers gave very little weight to prior knowledge, and based their choices almost entirely on new evidence, while in other circumstances new evidence had little influence on opinions already formed. The conclusion Simon made is that SEU theory does not provide a good prediction of actual behavior (Simon 1979).

The general features of bounded rationality - selective search, satisficing - have been taken as the starting points for a number of attempts to build theories: e.g. Cyert and March, Baumol, Leibenstein, Williamson, Nelson and Winter, Radner, Simon 1979). They used the notions of bounded rationality; the need to search for decision alternatives, the replacement of optimization by targets and satisficing goals, and the mechanisms of learning and adaptation (Simon 1957). Nowadays, we have knowledge of the mechanisms of human rational choice and we do know how people seek out alternatives, calculate consequences, and resolve uncertainties.

2.2.3 Why we choose Simon´s decision making theory?

Over the past fifty years a large body of positive evidence has also accumulated about the processes that people use to make difficult decisions and solve complex problems. The theory has been built up around evidence called information processing psychology. Newell and Simon (1972) have summed up their version of this theory: Human problem solving, an information processing framework with a computer simulation as a central tool for expressing and testing theories.

Information processing theories envisage problem solving as involving very selective search through problem spaces. Satisficing criteria terminate a search when satisfactory problem solutions have been found (Newell and Simon 1972). Thus, these theories of problem solving fit within the framework of bounded rationality. The main import to economic theory of research in information processing psychology is to provide rather conclusive empirical evidence that the decision-making process in problem situations conforms closely to the models of bounded rationality. This finding implies, that choice is not determined uniquely by the objective characteristics of the problem situation, but also depends on the particular heuristic process that is used to reach the decision. It would appear, therefore, that a model of process is an essential component in any positive theory of decision making that purports to describe the real world (Simon 1978).

A number of competing theoretical frames for modelling consumer decisions exist; ranging from general decision making models to specialized purchase process models. To guide the selection of our framework, we set a number of criteria. 1) Since we are seeking to apply the framework to chart the composition of a single concept, we need a framework in which the salient components of the concept are consistently on the same level of abstraction. 2) The framework should obtain the same dimensionality for the uncertainty concept as that insinuated by the consumer search literature. In other words, the framework should meet the criteria of completeness and parsimony. 3) Last, the framework should allow easy operationalization of the uncertainty concept as it is our goal to develop a measurement instrument that could be used by academics and practitioners alike (e.g. segmentation) (see paper III, Korhonen et al.).

Herbert Simon (see e.g. 1960, 2) established the dominant model of the decision-making process as a three phase "intelligence-design-choice" sequence (Langley, Mintzberg et al. 1995), which was later supplemented with a fourth stage of “implementation” (Newell and Simon 1972). For Simon (1957) the task of decision making involves three steps: 1) listing of

all the alternative strategies, 2) determination of all the consequences that follow upon each of these strategies; a comparative evaluation of these sets of consequences, 3) choice of the alternative strategies. According to Sprague and Carlson (1982) in this phase the choice is made, and also implemented. Although the third phase includes implementation, many authors feel that it is significant enough to be shown separately, as a fourth phase of this decision making process. We will use this extended model.

In the intelligence phase**,** consumers are listing of all the alternative strategies (Simon 1957). In the first phase of decision making according to Simon (Simon 1957), consumers obtain, process, and examine the raw data for clues that it may identify problems. In the other words, we are searching the environment for conditions calling for decisions (Sprague and Carlson 1982).

In the design phase, the consumer determine of all the consequences that follow upon each strategy and evaluate the sets of consequences (Simon 1957). The word all is used advisedly as it is often impossible for the decision maker to identify all of the alternatives, or their consequences. (Simon 1957). In this second phase of decision making (Simon 1957) we are inventing, developing, and analyzing the possible consequences. In the other words, consumers process to understand the current problem, they evaluate the alternatives and the attributes to generate solutions, and to test solutions for feasibility (Sprague and Carlson 1982).

In the choice phase of decision making, we choose the product or strategy. In the phase consumers select a particular course of action, from those available. Consumers make everyday decisions regarding choice, purchase and use of products and services. These decisions are often important to consumers and thus difficult to make. Consumers are often faced with a large number of alternatives and a great deal of information available from many sources. A typical consumer choice consists of a set of alternatives, each described by several attributes (Bettman, Johnson and Payne 1990).

In the implementation phase**,** consumers put the chosen strategy to use. In this study, we handle the implementation as a separate phase. The implementation phase is important to consumers and there are many uncertainties regarding this phase of decision. According to Torkzadeh and Dhillon (2002), in electronic markets especially, there are many uncertainties, for example online payment, vendor trust, shopping travel, and shipping errors.

Simon's decision-making process is one model of many information processing and consumer choice models. We see some promise as a framework for consumer choice-related uncertainty. We base our selection

of the framework primarily on completeness and parsimony; the consumer behavior literature suggests the presence of four dimensions of uncertainty, which limits our alternatives to a handful of models, those with four identified stages. To choose among these models, we next turn to examine their content.

Simon's model is a description of a general decision making process as opposed to consumer purchase or information processing models, which mostly attempt to capture the sequence of acts in a purchase process rather than focus on the distinctive stages of decision making as such.

The model implicitly embraces the concept of uncertainty because ambiguity is the precondition for boundedly rational decision behavior, and the stages of the model also closely match the dimensions of uncertainty we have identified through the review of consumer behavior literature.

As it is our aim to identify the general dimensions of uncertainty facing consumers in any purchase, we deem that the model of decision-making process put forward by Simon best fits this goal. The model suggests that four logically distinct dimensions can be identified in any decision.

2.3 Uncertainty

2.3.1 Decision making phases linked to uncertainty constructs definitions

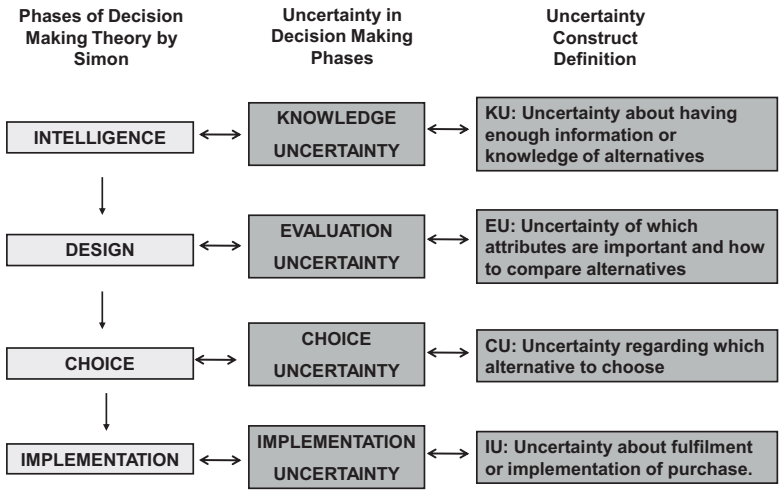

Figure 2: How we found the decision making phases linked to the four uncertainty constructs

This section presents a new way of definition of uncertainty constructs. The dimensions of uncertainty, proposed by Urbany et al. (*ibid.),* provide the central ingredients for our study as well as Simon's decision making process. Urbany, Dickson and Wilkie (1989) defined uncertainty as "the amount of information the buyer brings to the search process". We will next define the two uncertainty dimensions found in the previous literature: Knowledge and choice uncertainty, and furthermore, the uncertainties for the design and implementation phase of decision making process.

2.3.2 In the Intelligence phase - Knowledge uncertainty

In this intelligence phase of decision making, we see a contribution to Stigler's Knowledge uncertainty shown in his seminal paper on Economics of Information in 1961. We define Knowledge uncertainty (KU) as uncertainty about having sufficient information or knowledge of alternatives. Knowledge uncertainty regards what is known about the alternatives of the specific decision problem. Knowledge uncertainty may also be related to uncertainty over how to acquire the necessary information to make a choice.

In the literature, the original construct of knowledge uncertainty is drawn from Stigler's Economics of Information theory (EOI) (Stigler 1961). Knowledge uncertainty (KU) captures the doubts consumers have about their own ability to judge sellers and products well enough to execute rational product comparisons (Stigler 1961). Urbany (Urbany 1986) has defined knowledge uncertainty as uncertainty about knowledge of the alternatives and variables - what is known about alternatives. Knowledge uncertainty may arise from a lack of factual information about alternative choices and/ or uncertainty over what decision rules are relevant (Urbany, Dickson and Wilkie 1989). Knowledge uncertainty may also be related to uncertainty over how to acquire the necessary information to make a choice.

The negative knowledge uncertainty effect would be consistent with the cost-benefit theory of search (Stigler 1961). Therefore, greater knowledge might reflect the higher cost of search (Bettman 1979). The proposed negative relationship between search cost and search is well known (Urbany, Dickson and Wilkie 1989, Bettman 1979, Stigler 1961). High KU is associated potentially with a reduced ability to comprehend and efficiently use new information, which makes information search a more difficult process.

2.3.3 In the Design phase -Evaluation uncertainty

In this design phase of decision making, we see a contribution to Evaluation uncertainty. Evaluation uncertainty (EU) reflects uncertainty about how to integrate the information available to form judgements about brands or alternatives. Evaluation uncertainty occurs when consumers are not able to measure or compare different alternatives and value criteria. We propose that if evaluation uncertainty is high, consumers have difficulty in comparing products, because the available information is in a non-comparable form or the information is about different decision criteria and so non-comparable for the purpose of the current choice and decision. However, in the case of evaluation information, consumers have information about the alternatives, and are still not able to evaluate them. Urbany, Dickson and Wilkie (1989) noted in their study, that evaluation uncertainty might exist, but did not describe it further. In this dissertation, we define evaluation uncertainty to capture the product category-related (i.e. evaluative) doubts.

2.3.4 In the Choice phase- Choice uncertainty

In this choice phase of decision making, we see contribution to Lanzetta´s Choice uncertainty (Lanzetta 1963). Choice uncertainty (CU) means uncertainty about which alternative to choose (Urbany 1986), (Urbany, Dickson and Wilkie 1989). The original construct of choice uncertainty is from Lanzetta (1963). Lanzetta says that choice uncertainty occurs when the “choice of the best alternative is equivocal” in the context of resolving a conflict. Urbany et al. (1989) defined choice uncertainty as uncertainty regarding which alternative to choose. According to these authors, choice uncertainty covers questions such as what and where to buy.

Lanzetta (1963) found that choice uncertainty increase search activity, similar to his other construct “response uncertainty”. The characteristics of a choice set (i.e., experienced similarities or differences between the current alternatives) contribute to choice uncertainty (Lanzetta 1963). Information search will be greater when the choice sets are similar, due to the choice uncertainty generated (Lanzetta 1963). Sieber & Lanzetta (1964) predict that low choice uncertainty may result from poor knowledge of available choice-set. Urbany, Dickson and Wilkie (1989) found in their study, that choice uncertainty increases search behavior.

2.3.5 In the Implementation phase- Implementation Uncertainty

In this implementation phase of decision making, we see a contribution to a new uncertainty construct of implementation uncertainty. In this dissertation, we describe implementation uncertainty as uncertainty of the fulfilment of the purchase. The implementation phase is important to consumers and there are many uncertainties regarding this phase of decision. Especially in electronic markets, consumers face implementation uncertainty in online payment, vendor trust, postage and packing charges, and shipping errors (Torkzadeh and Dhillon 2002).

2.3.6 Development of Measurement Scales for Uncertainty Dimensions

No instrument should be used without adequate reliability and validity. The paradigms for measurement development (Churchill 1979, Nunnally 1978) suggest an iterative process: examining measurement properties to purify and re-specify scales to develop rigorous measures. The measurement development process includes a confirmatory cycle where the factor structure model proposed during the exploratory phase is confirmed using data (Churchill 1979, Nunnally 1978).

Confidence in a measurement model is increased when the constructs and their respective measures are confirmed (Churchill 1979, Peter 1979, Saarinen 1996, Nunnally 1978). Widely used instruments in the MIS discipline have several characteristics that promote their use: they are theory based, they are developed using established psychometric methods, and they are confirmed for reliability and validity (Churchill 1979, Peter 1979, Nunnally 1978). Furthermore, they propose constructs that are intuitively appealing, and they are easy to use in a variety of research and practice settings (Churchill 1979, Peter 1979, Nunnally 1978).

In the first stage of developing the measurement instrument, we conducted a pilot study (Lauraeus-Niinivaara et al.2007, 2008). Then we read the literature and generated the items measuring uncertainty. In order to test the factor structure more rigorously, we conducted confirmatory factor analyses using the factor analysis with varimax rotation. To estimate the reliability of the instrument, we undertook reliability tests by Cronbach's alpha (Cronbach 1979), which examined the internal consistency of each of the measured uncertainty dimensions. We also carried out a literature review about the latest models of measurement development (Chang et al. 2004, Yang 2005, Torkzadeh and Dhillon 2002, Saarinen 1996, Doll and Torkzadeh 1988).

Pilot study

We have learned that analyzing uncertainty as a multidimensional construct was fruitful, but we where rather critical towards the detailed uncertainty measures we used. In the pilot study, we studied the validity and the structural relationship of the uncertainty constructs and their effect on consumer search processes and pre-purchase search behavior. The effect of individual differences and purchase situations on search behavior is complex, often interactive and difficult to interpret and generalize (Nunnally 1978). Therefore, we chose as similar and consistent a group as possible for our observation research. Our response group consisted of 56 teenagers aged 12-15 year from the same demographic area. The method we used in this pilot study is empirical observation. We have chosen this method in order to find out what people really do in a search and purchase situation, instead of simply asking what they think they would do. The more specific description of our method is presented in our working papers and previous paper on the observation research (Lauraeus-Niinivaara et al. 2007, 2008). We conducted observations during three days in April and May 2004 at the school's premises.

Literature review of uncertainty item generation

A typical consumer choice consists of a set of alternatives, each described by several attributes (Bettman, Johnson, & Payne 1990). There are also failures of knowing all the alternatives, uncertainty about relevant exogenous events, and the inability to calculate consequences (Simon 1979). Furthermore, consumers are usually faced with non-comparable information and difficult value trade-offs, such as price versus using time, or quality, or safety (Bettman, Johnson, & Payne 1990).

Elements such as alternatives, attributes of value, and uncertainty directly affect the difficulty of consumer choice. Why it is difficult to make choice? Because of the large product differences, the large price dispersion, and the large amount of alternatives. Choice difficulty generally increases 1) as the number of alternatives and attributes increases, 2) if at least one of the attribute values is difficult to process, 3) if there is high uncertainty concerning the attribute values, and 4) as the number of attributes shared by the options decrease (Bettman, Johnson, & Payne 1990).

In the first stage of the analyses we treated the knowledge and choice uncertainty as the constructs of uncertainty, but the first empirical analyses showed that there was a considerable need to separate the uncertainty constructs for the four different phases of decision process. In response to the feedback on our pilot study, we went back to the literature and sought better measures of uncertainty. We conducted a large literature review and

with item generation we used many references and the most important ones are shown in the table 1. Conceptually uncertainty is close to concepts such as knowledge, familiarity and confidence often related to consumer search. It can be said that uncertainty and knowledge represents the two sides of the coin.

Knowledge embodies what is known while uncertainty refers to the difference of desired and perceived state of knowledge. Hence, uncertainty relates the information possessed to the informational needs of the consumer. The strength of the knowledge concept is that it can be modeled as inner organization of information, e.g. memory structures. Its weakness lies in its ambiguous relationship with overt consumer search behavior, for search is motivated by perceived lack of knowledge, not knowledge as such (Stigler 1961).

Reference				
DECISION MAKING PHASE BY SIMON	**INTELLIGENCE**	**DESIGN**	**CHOICE**	**IMPLEMENTATION**
UNCERTAINTY DIMENSIONS	**KNOWLEDGE UNCERTAINTY**	**EVALUATION UNCERTAINTY**	**CHOICE UNCERTAINTY**	**IMPLEMENTATION UNCERTAINTY**
Urbany, Dickson and Wilkie 1989	Knowledge Uncertaint	Evaluation Uncertainty	Choice Uncertainty	-
Stigler 1961	Knowledge Uncertainty	Knowledge Uncertainty	-	-
Lanzetta1963, Sieber & Lanzetta 1964 , Lanzetta& Driscoll 1968	-	-	Choice Uncertainty	-
Moorthy, Ratchford and Talukdar 1997	Individual Brand Uncertainty	Relative Brand Uncertainty / Brand specific uncertainty	-	-
Punj and Staelin 1983	Product Categery Knowledge	Usable Prior Knowledge	-	-
Brucks 1985	Product Class Knowledge	Brand Knowledge	-	-
Fiske, Luebbehusen, Miyazaki & Urbany 1994	Product Category Knowledge	Brand Knowledge	-	-
Beatty and Smith 1987	Product Category Knowledge	-	-	-
Park et al. 1994	-	Purchase Related Knowledge	-	-
Alba and Hutchinson 1987	-	Relative Brand uncertainty	-	-
Torkzadeh and Dhillon 2002	-	-	-	Electronic Market Related Uncertainty

Table 1: The references we used to develop the uncertainty dimensions in different decision making phases

As it is our aim to re-conceptual and test the effects of knowledge and choice uncertainty on consumer search, we need to partial out the abstract knowledge dimension, or evaluation uncertainty. This should result in uncertainty concept that will more closely follow observations on subjective knowledge evaluations (Park, Mothersbaugh et al. 1994).

While uncertainty has received a lot of attention in general decision making literature (Einhorn and Hogarth 1981), relatively seldom has it been targeted directly in consumer behavior literature. Uncertainty has been, however, studied indirectly thorough other constructs, such as subjective knowledge, experience, and confidence.

Table 1 shows the item we generated to measure uncertainty on four dimensions. In the table are also the references we used to generate the uncertainty dimensions. References concerns knowledge as well as uncertainty.

Stigler, in his seminal paper on economics of information, established that uncertainty is the driving force behind consumer search. Changing identity of sellers and buyers, and fluctuation in supply and demand result in uncertainty since information becomes obsolete (Stigler 1961).

Urbany et al. (1989) suggested that uncertainty is a multidimensional construct, and may have a more complex effect on consumer search, conditional to the dominant form of uncertainty involved in the purchase decision. They distinguished two types of uncertainty, labelled knowledge uncertainty (KU) and choice uncertainty (CU). Knowledge uncertainty captures doubts consumers have about their own ability to judge sellers and products well enough to execute rational product comparisons (Urbany et al. 1989). Choice uncertainty arises from the conflict about which alternative to choose (Lanzetta 1963, Urbany 1986; Urbany et al. 1989). While the former construct is close to the original idea of uncertainty put forth by Stigler (Stigler 1961), the latter is reminiscent of "response uncertainty" coined by Lanzetta (1963), who referring to Berlyne (1960) stated that uncertainty occurs when the "choice of the best alternative is equivocal" in the context of resolving a conflict.

Later, Moorthy et al. (1997) examined uncertainty as a central factor of consumers' problem framing and suggested that some degree of both knowledge and choice uncertainty are necessary antecedents of search as "in the common situation in which the consumer has brand-specific prior distributions, whether the consumer searches at all depends not only on involvement, search cost, and individual brand uncertainty but also on whether there is relative brand uncertainty." In their terminology individual brand uncertainty is close to knowledge uncertainty and relative brand uncertainty close to choice uncertainty.

Conceptually uncertainty is close to concepts such as knowledge, familiarity and confidence often related to consumer search. Knowledge embodies what is known while uncertainty refers to the difference of desired and perceived state of knowledge. Hence, uncertainty relates the information possessed to the informational needs of the consumer. The strength of the knowledge concept is that it can be modelled as inner organization of information, e.g. memory structures. Its weakness lies in its ambiguous relationship with overt consumer search behavior, for search is motivated by perceived lack of knowledge, not knowledge as such (Stigler 1961).

UNCERTAINTY DIMENSIONS AND ITEMS OF SCALES	REFERENCES WE USED TO DEVELOP ITEMS OF UNCERTAINTY SCALES
KNOWLEDGE UNCERTAINTY KU 1) the knowledge of alternatives KU 2) the different prices KU 3) the products differeces KU 4) where is the lowest prices	Urbany, Dickson and Wilkie 1989 p.209 ,Moorthy et al.1997 p.269, Fiske et al. 1994, Brucks 1985, Punj and Staelin 1983, Beatty and Smith 1987, Kiel and Layton 1981, Lehmann and Moore 1980, Smith and Spreng 1996, Stigler 1961 EOI, Ratchford 1982, Urbany 1986, Bucklin 1969, Claxton et al.1974, Udell 1966, Newman and Staelin 1972, Katona and Mueller 1955, Alba and Hutchinson 1987, Duncan and Olshavsky 1982
EVALUATION UNCERTAINTY EU 1) the main criteria on my choice EU 2) which attributes are the criteria EU 3) the most important criteria EU 4) own ability to compare information EU 5) information comparability EU 6) availability of comparable information	Urbany, Dickson and Wilkie 1989 p.209 and 214, Moorthy et al. 1997, Alba and Hutchinson 1987, Brucks 1985, Fiske, Luebbehusen et al. 1994, Punj and Staelin 1983 p.368 , Park et al. 1994, Lehmann and Moore 1980, Beatty and Smith 1987 , Weizman 1979 Duncan and Olshavsky 1982,Weitzman 1979, Moorthy, Smith and Spreng 1996, Johnson and Russo 1984
CHOICE UNCERTAINTY CU 1) to choose product CU 2) to choose brand CU 3) to choose an alternative CU 4) to choose where to shop	Lanzetta 1963, Sieber & Lanzetta 1964 , Lanzetta & Driscoll 1968, Urbany, Dickson and Wilkie 1989 p. 209, Moorthy, Ratchford and Talukdar 1997, Beatty and Smidt 1987, Duncan and Olshavsky 1982, Bettman et al. 1991, Kiel and Layton 1981, Alba and Hutchinson 1987
IMPLEMENTATION UNCERTAINTY IU 1) problems in purchasing IU2) problems to go to the store IU 3) product availability at purchase time IU 4) fulfilment of delivery of the product IU 5) problems in purchasing the product IU 6) fulfilment on delivery price IU 7) fulfilment of adds promised delivery	Moorthy, Ratchford and Talukdar 1997 p.264 Torkzadeh and Dhillon 2002 , Urbany, Dickson and Wilkie 1989 p.208 and 209 , Duncan and Olshavsky 1982, Beatty and Smith 1987, Furce, Punj and Steward 1984, Schmith and Spreng 1997

Table 2: References used to develop the items measuring uncertainty in different dimensions

Uncertainty consists of four uncertainty constructs

To sum, existing literature on uncertainty has identified and tested two dimensions of uncertainty: knowledge uncertainty and choice uncertainty. Further, existence of a third dimension, evaluation uncertainty, has been suggested but not tested. Evaluation uncertainty promises to resolve the problem of less than perfect discriminant validity of the original uncertainty

constructs, and is a promising candidate for a third dimension of uncertainty. Finally, implementation uncertainty promises to provide the means of accounting for purchase process-related doubts that are projected prior to purchase decision.

Taken together, our re-formulation of the uncertainty concept (see paper 3: "Uncertainty in Consumer Decisions") and the preceding discussion about the relationship of uncertainty and consumer search allow us to make the following propositions, which will serve as the basis for developing our research hypotheses and operationalizing the key concepts. Four conceptually distinct dimensions of uncertainty appear to influence consumer search behavior. Knowledge uncertainty captures the brand knowledge related doubts while evaluation uncertainty captures the product category related (i.e. evaluative) doubts. Choice uncertainty encapsulates the doubts over committing to the alternative judged best. And, finally, implementation uncertainty captures the doubts related to seeing through the transaction. We will next discuss how to develop measurement scales for these four dimensions.

Item generation for the scales of four uncertainty dimensions

We generated seven iterations together with two senior professors and one assistant professor when creating the items of each uncertainty dimensions. On the base of decision phases we decided to extend uncertainty to provide better coverage of the essential decision phases. We generated the items for measuring the four uncertainty dimensions introduced above: knowledge uncertainty, evaluation uncertainty, choice uncertainty, and implementation uncertainty. With uncertainty measure generation we used many references and the most important ones are shown in the table 2.

As said above, uncertainty has been, however, studied indirectly thorough other constructs, such as subjective knowledge, experience, and confidence. In the table are also the references we used to generate items for uncertainty dimensions.

Control group feedback

The first attempt at an empirical assessment of the validity of the measurements instrument was made by using experts as a control group. The group consists of together 17 experts: 4 professors of Helsinki School of Economics, 4 doctoral students of department of information system science, 6 consultants of information system sciences, 3 ISS directors of Finnish companies in Finland.

First, we used a questionnaire consisting of questions concerning how respondents think that our proposals really measure different uncertainty in different phases of decision process by Simon (1957). This information

was interpreted and used for assessing whether our main constructs and detailed items are valid and representative.

The control group commented on the detailed items included in the questionnaires and tried to improve them. Some of the questions were refined on the basis of this feedback. Finally, group of members of control group filled in the whole questionnaires. After refining some details of the instrument, the advisory group approved the questionnaires.

Based on the above findings, we believe that content validity received support. The answers were easily interpreted via our instrument. The control group helped us also to refine the questionnaires to a level that was satisfactory to them. However, further attempts to analyze validity are clearly needed.

Tests of the measurement scales

In the final phase of measure developing process, we tested our uncertainty measures for reliability, content validity, predictive validity and construct validity. The results of tests are shown in findings of the paper III.

3. Methodology of the study

The empirical study in this dissertation focused on uncertainty in consumer online search and buying behavior and the decision making process. This section provides an overview of item generation, data collection and analysis methods.

EMPIRICAL PHASE	**Focus**	**Study**	**Data**	**Methods**	**Outcomes**
Phase 1: 2004 Data Collection 2004-2007 Data Analysis	Knowledge and choice uncertainty, pre-purchase search process, outcome of search	Quantitative: Semi-structured observation study of pupils	N=56	T-Tests	Paper 1:HICSS Conference Paper 2007 Paper 2: HICSS Conference Paper 2008
Phase 2: 2006 Data Collection 2007-2010 Data Analysis	Uncertainty in decision making phases, search determinants relation to uncertainty and satisfaction of purchase	Quantitative: A Mail survey. Target group was 2000 Finnish people	N= 639	Principal Component Analysis, Factor Analysis, Regression Analysis	Paper 3: Aalto University, School of Economics, Working Paper Paper 4: HICSS Conference Paper 2010 Paper 5: Aalto University, School of Economics, Working Paper

Table 3: Research process

In the first phase of the study, in the pilot study we studied the validity and the structural relationship of the uncertainty constructs and their effect on consumer search processes and pre-purchase search behavior. The method we used in this pilot study was empirical observation. We conducted observations during May 2004 at their school premises. The outcome from the first phase of the study is two HICSS Conference papers.

In the second phase of the study, we aimed to model the structure of consumer decisions related uncertainty from the decision making perspective. We conducted a mail-survey for the period from May through

June 2006. The respondents were obtained by drawing a random sample of 2000 Finnish people. The outcome of the second phase of the study is a HICSS Conference paper and two Aalto University, School of Economics working papers.

3.1 Observation research

The effect of individual differences and purchase situations on search behavior is complex, often interactive, and difficult to interpret and generalize. Therefore, we chose group as similar and consistent as possible for our observations and interview research. Our sample consisted teenagers of 12-15 year old from the same demographic area. Our observation was the same for every respondent; interactive purchase via Internet without time limits.

The method used in this study is observation and interview. We chose this method in order to discover what people really do in a search and purchase situation, rather than simply asking what they think they would do. We chose this target group because we felt that pupils have not yet established ways of searching information on the Internet.

We conducted observations during three days in April and May 2004 at the school's premises. There was always one observer present per pupil. All the observers had a PhD degree or were PhD students, and all had a full understanding of the research objectives and methods.

Briefly, the observational study was conducted in the following way: The observer explained the purpose and objectives of the study to the pupils who were asked to follow the general principle of the observational research - to speak aloud, i.e. comment on all the moves and reasons for their choices while they were searching for information. Background information on the pupils was gathered on a formal sheet and we used a standardized form to note the answers of the pupils. After each interview, the respective observer went through the results with the PhD student responsible for inserting the data in a database. The person who collated the data was the same all the time; thus it was ensured that every single observation was understood in the same way.

The design of the experiments in Pilot Study

We designed three assignments to measure the effects of knowledge and choice uncertainty on the search effort. The assignments were simple product search and comparison tasks during which the subjects were asked to state aloud their actions and the reasons behind them. The three assignments were worded as follows:

Assignment 1: Buy a Christmas present; a CD for your grandmother.
Assignment 2: Buy the Red Hot Chili Peppers' "By the way" CD for a friend.
Assignment 3: Buy a CD yourself.

In the first assignment, knowledge uncertainty was high while choice uncertainty was low. The subjects were unlikely to be familiar with the music categories when they searched for the CD, yet, choice uncertainty was low since the risks related to an adverse choice were low – the subject would not be stuck with the recording. The second assignment was designed to have both low knowledge and choice uncertainty. The music category should be familiar to most subjects and the task was narrowly framed to lower choice uncertainty. In the third assignment, knowledge uncertainty was low because the subjects were knowledgeable about the their own preferred music genres. Choice uncertainty, on the other hand, was high since they had the chance to win the recording and, therefore, were at some pressure to make a good choice.

The number of product attributes considered during the product choice may reflect two things: 1) product complexity, and 2) choice uncertainty. In our study, product complexity was controlled by using products of the same category through all of the assignments.

3.2 Mail survey

To collect further data, we conducted a survey for the period May to June 2006. The subjects were obtained by drawing a random sample of 2000 Finnish people. The sample frame was restricted to people between 18-65 year. To motivate the subjects, we announced a lottery to be held among all subjects participating in the study. The prize was one gift certificate, of euro 500 value, valid at a travel agent partnering our "Future Marketing" research program. Those subjects not responding to our query in the first round were contacted three weeks after, sending them again a paper version of questionnaire. After two attempts to contact the subjects, we had still failed to reach a number of them. Altogether we collected 639 responces. Thus, the response rate was 32%, which we deem adequate. Yet, to be more assured that our sample was representative of the Finnish people, we identified the demographic variables having a prominent role in relation to consumer search and compared our data on these with the latest census figures for the Finnish population.

Profile of respondents in Mail Survey

After examining the consumer search literature, we identified the following key demographics, related to search behavior: gender, age, education level, income, and location of residence.

Gender	**Frequency**	**Data %**	**Population * %**
Male	54,9	54,9	48,8
Female	39,6	39,6	51,2
Total	94,5	94,5	100
Missing	5,5	5,5	
Total	100	100	
Education	**Frequency**	**Data %**	**Population * %**
Comprehensive school education	127	19,87	41,5
Upper secondary school education	50	7,82	22,9
Vocational and professional education	159	24,88	12,7
Polytechnic education	163	25,51	12,6
University education	96	15,02	10,3
Missing	44	6,89	
Total	639	100	
Income Euros/yer	**Frequency**	**Data %**	**Population ** %**
-3000	31	4,85	7,8
3000 - 4999	22	3,44	3,34
5000 - 9999	18	2,82	17,23
10000 – 13999	33	5,16	12,39
14000 – 19999	45	7,04	14,23
20000 – 24999	69	10,8	12,47
25000 – 29999	49	7,67	9,77
30000 – 39999	72	11,27	10,43
40000 – 49999	70	10,95	4,53
50000 – 59999	49	7,67	2,01
60000 – 79999	49	7,67	1,66
80000 -	43	6,73	1,47
others			2,67
Missing	89		
Total	639		
Community size	**Frequency**	**Data %**	**Population * %**
The Metropolitan area	130	20,34	18,3
Town, > 45,000 inhabitants	123	19,25	21
Town, < 45,000 inhabitants	160	25,04	21,1
Urban or semi-urban municipality	39	6,1	16,5
Rural Municipality	127	19,87	23,1
Can´t choose of those	8	1,25	
Missing	52	8,14	
Total	639	100	

Table 4: The profile of respondents *Statistics Finland 2000, **Statistics Finland 2004

The table 4 presents both the sample and the population statistics. We ordered from Statistics Finland a random sample of the Finnish population aged between 18-65 years. We think that there are no problems to generalize the results of the study, but to be sure that no such problems exist we next report the major demographic deviations found in the data. We compared our data with population statistics extracted from the *Statistics Finland 2000 and **Statistics Finland 2004.

Gender. Table 4 shows that our respondents are 54,9 % males and 39,6 % females. The corresponding statistics of population in 2000 were 48,8 % males and 51,2 % females. Males are known to be greater users of the internet compared to females, so we see that our data corresponds to the current population of active Finnish internet users quite well.

Age. Our respondents were from 18 to 80 years old Finnish people. The age profile in our sample corresponds well enough to Finnish population. We obtained a higher percentage of samples from 30 to 79 years old than found in the population, but we might assume that our data corresponds to the current population of active Finnish internet users quite well.

Education. People who had received higher education were more active in their response to our questionnaire. Furthermore, people with lower education responded less than the average population in Finland, to our questionnaire. The “comprehensive school education” and “general school education” groups in our sample was smaller than in the Finnish population in average. Professional, polytechnic or university education groups in our sample are larger than in the population average. We might assume that our data corresponds to the current population of active Finnish internet users accurately.

Income. Our sample group has greater wealth than the Finnish population on average. In addition the percentage of well-being people is higher than that found in the average Finnish population.

Location of residence. Location of residence may affect internet search behavior. We might assume that our respondents represent the average Finnish population in case of location of residence quite well.

4. Findings

In this chapter, the results of the papers are reviewed from the perspective of their contribution to the objectives of the present study.

4.1 Objectives, Research Questions and Main Results of the Papers

Essay	Objectives	Research Questions	Main Results
Essay 1	To study the uncertainty constructs effect on consumer search behavior in electronic markets	How does uncertainty affect consumer online search behavior?	The connection of uncertainty and search behaviour in online pre-purchase context.
Essay 2	To study the combined effect of uncertainty and search process on the final outcomes of consumer online purchase	1) Does uncertainty influence the search pattern employed? 2) How does the search pattern or uncertainty influence on outcomes of search? 3) What is the combined effect of uncertainty and search pattern on the outcome of search measured by time and price?	Lack of relationship of uncertainty on choice of search pattern. Positive relationship of search pattern and efficiency and effectiveness of search outcomes.
Essay 3	To develop measurement scales of uncertainty for the different decision making phases	1) What are the dimensions of uncertainty in consumer online decision making? 2) What kind of items can be used to measure uncertainty?	The development of the measurement scales and items of uncertainty in the general decision making phases. we extended the uncertainty dimensions to include evaluation and implementation uncertainties.
Essay 4	To study the external search determinants relation to uncertainty	1) How is uncertainty related to the external search determinants in online purchase? 2) What kind of uncertainty consumers do perceive when purchasing online?	Only few external search determinants are relevan to consumer online purchasing. Uncertainty exists in all four dimensions of uncertainty.
Essay 5	To study the combined effect of uncertainty and search process on consumer satisfaction	What are the determinants behind consumer perceived satisfaction?	Involvement is related with consumer perceived satisfaction of purchase. The iterative search process lead to satisfaction of purchase.

Table 5: Research objectives, research questions and results

In this dissertation, objectives sit behind the main research question: "How uncertainty affects consumer online search behavior and purchase decision making." The table 5 shows the objectives, the research questions and the main results of each paper.

In the first paper, we aim to study how knowledge and choice uncertainty affect consumer search and buying behavior. In the second paper, we investigate the combined effect of uncertainty and search process on the final outcomes of consumer online purchase. In the third paper, our aim is to develop and test of the measurement scales and items of uncertainty in the general decision making phases. In the fourth paper, we focus on the influence of external search determinants on uncertainty. In the fifth paper, we aim to concentrate on satisfaction and thus we investigate the combined effect of search strategy and uncertainty to consumer perceived satisfaction.

All of the papers closely related to each other.

4.2 Paper I – Knowledge and Choice Uncertainty Affect Consumer Search and Buying Behavior

Lauraéus-Niinivaara Theresa, Saarinen Timo, and Öörni Anssi (2007). Knowledge and Choice Uncertainty Affect Consumer Search and Buying Behavior. *HICSS Conference paper* 3-6. *January* 2007

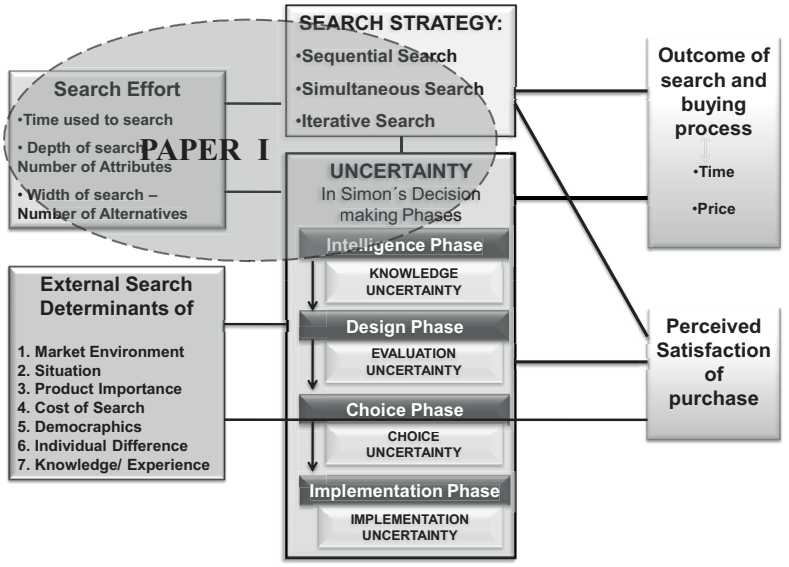

Figure 3: Research area of paper 1

In the first paper of this dissertation, we researched the general types of uncertainty: choice uncertainty (Lanzetta 1963) and knowledge uncertainty (Stigler 1961) the case of consumers that have very little experience of information search and who have not have "already learned" search behavior. In this study, we examine the structural relationships among the uncertainty constructs and their effects on information search. The implications of the findings for previous research on the relationship between uncertainty and search are discussed, along with research directions.

In the paper, we have demonstrated that uncertainty is a concept that can be used to explain variation in the extent of consumers' search in electronic markets. We have operationalized uncertainty by two constructs, knowledge uncertainty and choice uncertainty. Our analyses suggest that knowledge uncertainty affects shopping time while choice uncertainty affects the number of alternatives and the number of product attributes considered in the purchase decision.

4.3 Paper II – Relationship between Uncertainty and Patterns of Pre-purchase Consumer Search in Electronic Markets

Lauraéus-Niinivaara Theresa, Saarinen Timo, Sunikka Anne, Öörni Anssi (2008). Relationship between Uncertainty and Patterns of Pre-purchase Consumer Search in Electronic Markets. *HICSS Conference paper 7-10. January 2008*

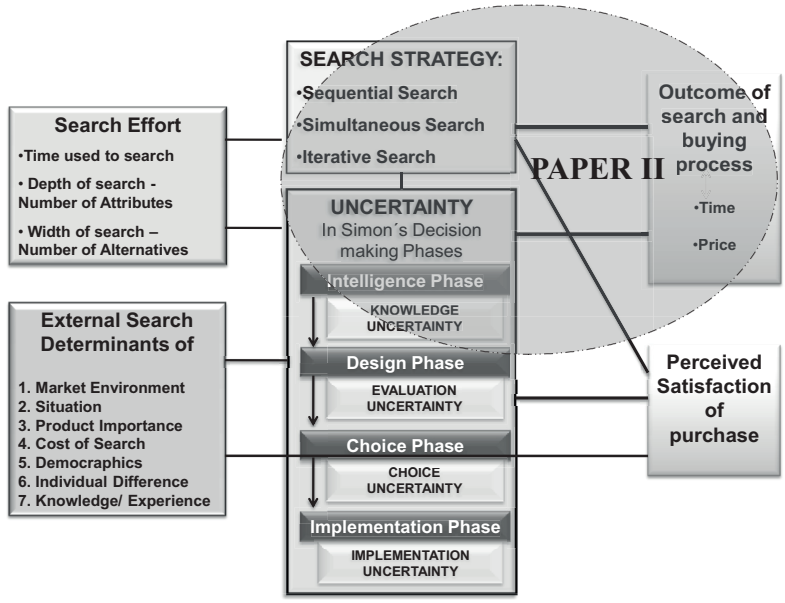

Figure 4: Research area of paper 2

In the second paper of this dissertation, we have demonstrated that search behavior together with uncertainty is a concept that can be used to explain the variation in the extent of consumer search in electronic markets. In the body of this paper, we first discuss the prototypical search patterns identified in consumer behavioral literature; sequential and simultaneous search. This work connects the pattern of the search process to the outcomes of search, i.e. price of purchase and time of search. We set up a laboratory experiment in which the subjects searched for compact discs in contexts with varying degree of purchase-related uncertainties. We observed the resulting search process, identified the prototypical patterns of search, and studied the impact of the patterns on the outcomes of search. The paper investigates the combined effect of uncertainty and search process on the final outcomes of consumer online purchasing.

We identified three types of search patterns in our experiment: sequential, simultaneous, and iterative. We found that the search pattern has an impact on search costs and the efficiency of search judged by the purchase price. A sequential search emerged as the dominant search pattern even though it leads to the most expensive purchase. Simultaneous search seems to combine low search costs with high efficiency. An iterative search pattern was the slowest form of search. We also studied the relationship between uncertainty and search pattern, because uncertainty should have an effect on the search pattern employed. We found that uncertainty is strongly related to search behavior, but not to the search pattern employed. In spite of uncertainty, a simultaneous search is fastest and presents the lowest price, and a sequential search is slowest and presents the most expensive price. In spite of the search process, high knowledge uncertainty leads to most time used and high choice uncertainty leads to the lowest price of purchase.

4.4 Paper III – Uncertainty in Consumer Decisions

Korhonen Pekka, Lauraéus Theresa, Saarinen Timo, and Öörni Anssi (2010). Uncertainty in Consumer Decisions, *Aalto University School of Economics, Working paper*

In the third paper of this dissertation, we aimed to model the structure of consumer decisions related uncertainty from the decision making perspective. Our objective was to conceptualize uncertainty further and

develop the measurement scales of uncertainty for the different decision making phases described in Simon´s Decision making theory.

We linked consumer behavior research with decision making research and conceptualized uncertainty constructs. We applied a theoretically coherent framework, the decision process model presented by Herbert Simon (1957, 67) in order to identify the salient dimensions of uncertainty and to test for their relevance in consumer pre-purchase behavior.

We followed strictly Nunnally´s "Psychometric theory" and Churchill´s advice, when creating and testing the uncertainty scales. We conducted a survey of 2000 Finnish consumers and we tested the measurement instrument with 639 consumers for reliability, content validity, predictive validity and construct validity.

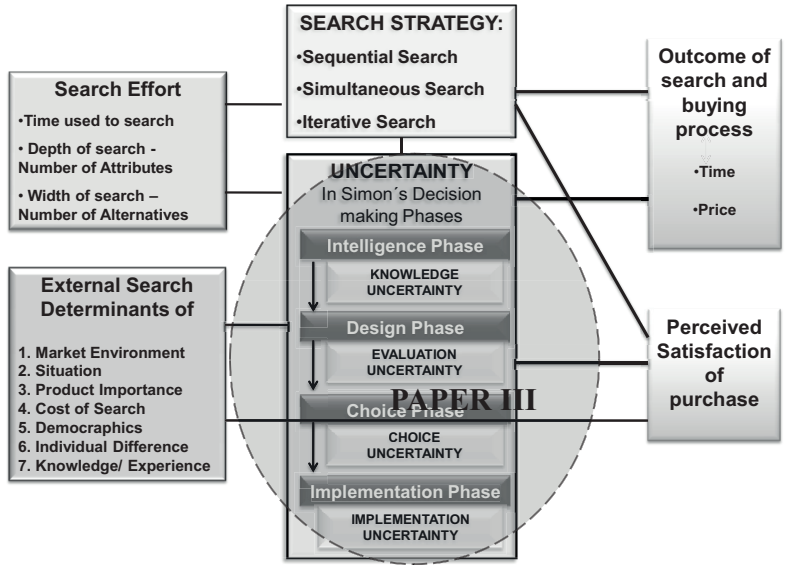

Figure 5: Research area of paper 3

4.4.1 Findings of tests of measurement instrument

The reliability of a measure reflects high internal consistency: the detailed items (questions) measure the same thing. In this study the reliability of the constructs was assessed by using Cronbach´s Alpha reliability coefficient (Cronbach 1951).

The reliability of a measure reflects high internal consistency. All these coefficients are between.80 and .89. Thus, the detailed items measure the same thing (Cronbach 1979).

Content validity means that we measure what we are supposed to measure. In other words, if we aim at a good measure of uncertainty constructs of different decision phases, we should be convinced that the measurement instrument includes the essential features of uncertainty (Churchill 1979). We achieved high content validity by a two phased research strategy which helped us in understanding the phenomena of uncertainty and we used the procedures used to develop measures widely accepted by academic society (Churchill 1979, Peter 1979, Nunnally 1978). We also connected uncertainty measures to the traditional decision making theory by Herbert Simon (1957). In addition, we used a control group to provide feedback and develop our ideas. Furthermore, addition to uncertainty measure tests, we pre-tested our paper questionnaire by a different age and demographics of consumers. We improved our questionnaire to be better understood by consumers and to be a lot of shorter. In addition, content validity was studied in the survey phase by analyzing correlations between total uncertainty and the dimensions of uncertainty, and also total uncertainty and the detailed items measuring different uncertainties. In this study Content validity is good for all main constructs and for most of the items, and we are convinced that the measurement instrument includes the essential features of uncertainty.

Predictive validity assesses whether an item measured is associated with the main construct. In this study, predictive validity is analyzed by correlations to control variable in each dimensions of uncertainty. All items and control variables correlations, except IU3 and IU4, are acceptable and most are significant $p<.0001$ level. Thus, we will drop them out.

Correlations between the developed scales and control variables were used to study the predictive power of detailed measures of each uncertainty dimensions. In this study, the predictive power of detailed measures of KU, EU and CU are excellent. The values for KU, EU and CU are significant at $p<.0001$ level. The predictive validity of Implementation Uncertainty is sufficient, when we dropped out IU3 and IU4.

Construct validity, in this case, means that the underlying structure of the developed construct is found also in reality. A most powerful method for analyzing construct validity is factor analysis. Most of the values are higher than .70, which is a very good result. All values above .50 are acceptable and thus, all of our loaded factor values are good, when we shift the the values of IU1 and IU2 to Choice Uncertainty.

Our tests suggest that four dimensions, knowledge uncertainty, evaluation uncertainty, choice uncertainty, and implementation uncertainty are major determinants of total uncertainty related to consumers' pre-purchase decision process.

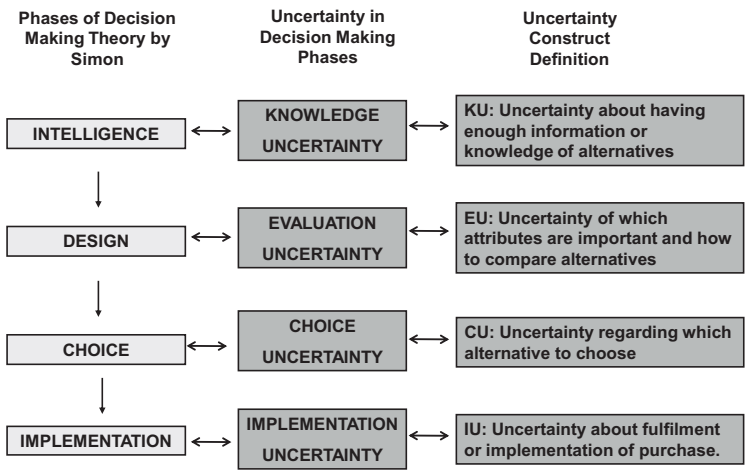

Figure 6: Uncertainty concepts and definitions linked to decision making phases proposed by Simon 1957

Our tests suggest, the final items of uncertainty scales are:

KNOWLEDGE UNCERTAINTY • Uncertainty about the alternatives • Uncertainty about the prices • Uncertainty about different products • Uncertainty about where is the lowest prices
EVALUATION UNCERTAINTY • Uncertainty of the main criteria on my choice • Uncertainty of which attributes are the criteria • Uncertainty of the most important criteria • Uncertainty of own ability to compare information • Uncertainty of comparability of the information • Uncertainty of availability of comparable information
CHOICE UNCERTAINTY • Uncertainty of having difficulties to choose product • Uncertainty of having difficulties t to choose brand • Uncertainty of having difficulties to choose an alternative • Uncertainty of having difficulties to choose where to shop
IMPLEMENTATION UNCERTAINTY • Uncertainty of having problems in purchasing • Uncertainty of having problems to go to the store • Uncertainty of having problems in purchasing the product • Uncertainty of fulfilment on delivery price • Uncertainty of fulfilment of adds promised delivery

Table 6: The final items of uncertainty scales

4.5 Paper IV – Uncertainty is the other side of the coin of information online search

Lauraéus-Niinivaara Theresa, Uncertainty is the other side of the coin of information online search, *HICSS Conference paper 5-8. January 2010*

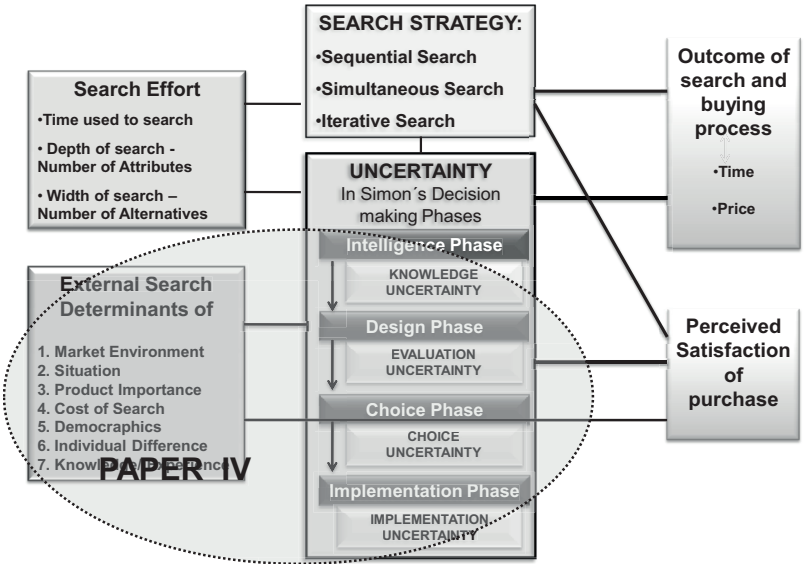

Figure 7: Research area of paper 4

In this paper, we assume online purchasing process as a search process; linking it to a search theory base and the general decision making phases described by Simon 1957. We base our study on Beatty and Smith´s (1987) research of external search determinants. In this paper, we studied 1) how uncertainty is related to the external search determinants in an online purchase, and 2) what kind of uncertainty consumers perceive when purchasing online. In the body of this paper, we first discuss the factors identified behind the consumer pre-purchase information search in consumer behavioral literature.

Beatty and Smith 1987 found that consumers search more if the purchase is an expensive, more visible, or complex product, and consumers search more for products that include "greater perceived risk". Thus, this made us to raise the question; "How uncertainty relate to the external search determinants in online purchase."

As a conclusion to this study, we are able to see that all consumers perceive uncertainty in all four different decision making phases, despite the education level, income, age, or individual differences of consumers. Our tests suggest that four dimensions of uncertainty: knowledge

uncertainty, evaluation uncertainty, choice uncertainty, and implementation uncertainty are the major determinants of total uncertainty related to consumers´ pre-purchase decision process in online markets. In this paper we linked consumer perceived uncertainty to external search determinants and decision making phases.

The external search determinants that have most influence on consumer perceived uncertainty are: "information availability", "attribute importance", "difficult to choose a brand", "store distribution", and "perceived variance in retail operations". Those variables fit well the four uncertainty constructs definitions.

When thinking of the groups of external search variables, the "market environmental variables" and the "product importance variables" most explain consumer uncertainty. Demographic and individual variables have least influence on consumer perceived uncertainty.

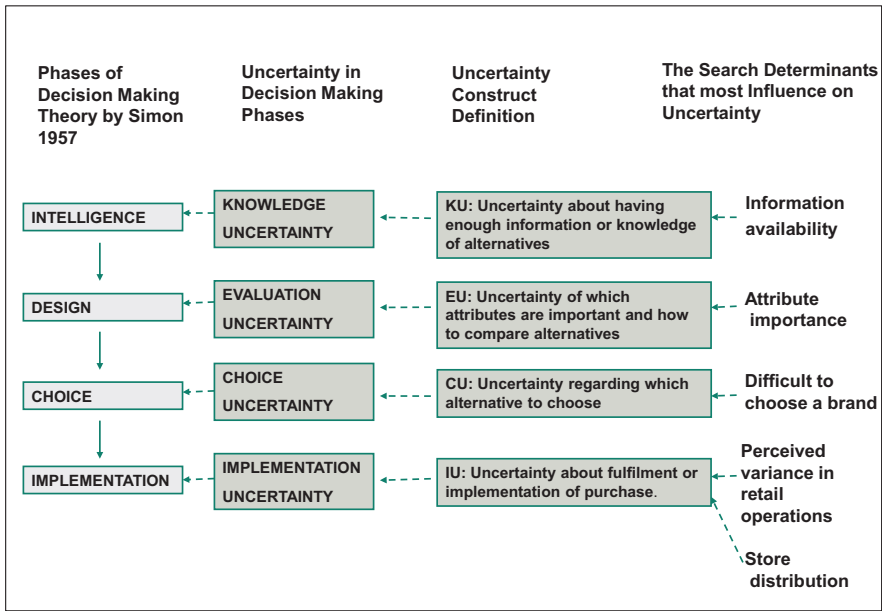

Figure 8: The external search determinants that most influence on uncertainty

4.6 Paper V- Impact of Online Pre-purchase Search on Consumer Satisfaction

Korhonen P., Lauraéus T., Saarinen T., Öörni A., "Impact of Online Pre-purchase Search on Consumer Satisfaction", *Aalto University, School of Economics, Working paper*

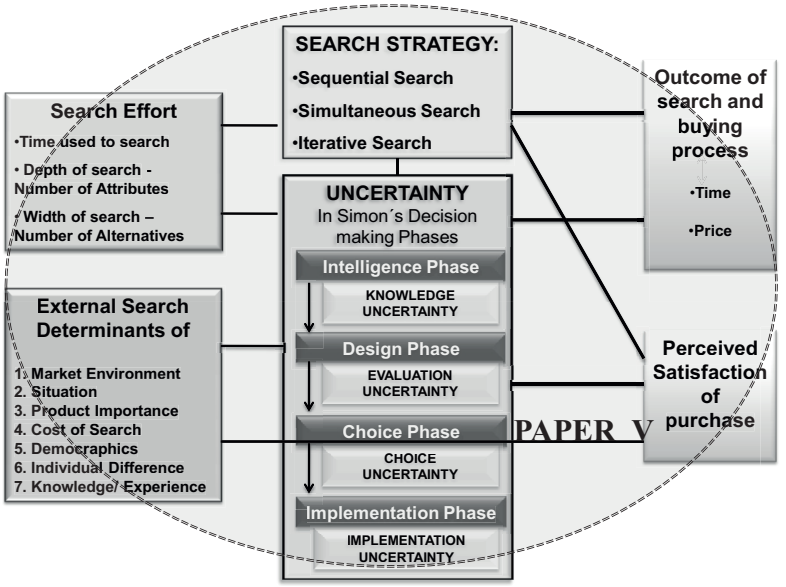

Figure 9: The research area of paper 5

In this fifth paper, we assume the consumer online buying process as a decision making process linking it to perceived satisfaction of purchase. In the paper, we study the impact of uncertainty and external search determinants to consumer perceived satisfaction of travel purchase on electronic markets. We base our study on Beatty and Smith´s (1987) research of external search determinants and take a look at the determinants impact on satisfaction with a sample of 604 consumers. We also study, how three types of search processes (comparison-shopping/ agent search, sequential search, and iterative search) influence consumer perceived satisfaction of travel purchase.

Consumers that are satisfied with quality of travel most often used an iterative search. It seems that the iterative search process leads consumers to satisfied purchase. Consumer perceived satisfaction of travel online purchase relate more to uncertainty than the external search determinants. Contrary to previous wisdom, in the electronic commerce context, evaluation and implementation uncertainties seem to exercise a stronger impact on consumer decisions than the other varieties of uncertainty.

5. Discussion and Conclusions

The empirical studies presented in this dissertation focused on uncertainty in consumer online search and buying behavior, and uncertainty in the consumer decision making process.

The main objective of this dissertation was to conceptualize uncertainty further, to develop measurement scales for the four dimensions of uncertainty, and to test their reliability and validity by studying the uncertainty constructs via the extended decision making phases proposed by Simon (1979). We assumed the online purchasing process to be a search process, linking it into a search theory base, uncertainty and the general decision making literature.

Firstly, we studied the structural relationship of the uncertainty constructs and consumer pre-purchase search strategies. Secondly, we studied the combined effects of search strategy and uncertainty on the effectiveness of the consumer buying process and consumer perceived satisfaction. Finally, we aimed to test the role of uncertainty in consumer decision making.

Consumer perceived satisfaction of online purchase relates more to uncertainty than to the external search determinants. One explanation might be that it may be more important for a consumer to feel that s/he knows what s/he is doing than to know that s/he is making the most optimal choice.

5.1 Uncertainty influence on search behavior

Higher levels of knowledge uncertainty (KU) motivate consumers to increase pre-purchase search; higher levels of evaluation uncertainty (EU) discourages search through making learning new product information more difficult; and, finally, higher levels of choice uncertainty (CU) encourages more extensive search as consumers have difficulties identifying diagnostic product attributes, especially when choice alternatives are nearly equally attractive (for a discussion of consumer underconfidence, see Alba and Hutchinson 2000, 133). Implementation uncertainty (IU) connects our

uncertainty concept to consumer loyalty and its antecedent – trust. How IU operates on search depends on the decision strategy applied. When conjunctive decision models are applied, IU operates by constricting the consideration set because untrustworthy sellers are weeded out. In disjunctive, lexicographic, and compensatory strategies IU merely adds an item to the preferences structure.

5.2 Theoretical contribution

Taken together, our re-formulation of the uncertainty concept and the preceding discussion about the relationship of uncertainty and consumer search allow us to make the some general statements which will serve as the basis for developing our research hypotheses and operationalizing the key concepts: Four conceptually distinct dimensions of uncertainty appear to influence consumer search behavior. Knowledge uncertainty captures the brand knowledge related doubts, while evaluation uncertainty captures the product category related (i.e. evaluative) doubts. Choice uncertainty encapsulates the doubts over committing to the alternative judged best. And, finally, implementation uncertainty captures the doubts related to seeing through the transaction. The first three uncertainties fit nicely with Newman's (1977) keen observation: search activity increases when the consumer believes that the purchase is important, there is a need to learn more, and s/he can easily obtain and utilize information. Thus, they show some promise towards accounting for the motivational, encoding, and selective search effects. Higher levels of KU motivate consumers to increase pre-purchase search, higher levels of EU discourages search through making learning new product information more difficult, and, finally, higher levels of CU encourages more extensive search because consumers have difficulties identifying diagnostic product attributes, especially when choice alternatives are near equally attractive (Alba and Hutchinson 2000, 133). Implementation uncertainty (IU) connects our uncertainty concept to consumer loyalty and its antecedent, trust. How IU operates on search depends on the decision strategy applied. When conjunctive decision models are applied, IU operates through constricting the consideration set because untrustworthy sellers are weeded out. In disjunctive, lexicographic, and compensatory strategies IU merely adds an item to the preferences structure.

In summary, existing literature on uncertainty has identified and tested two dimensions of uncertainty: knowledge uncertainty and choice uncertainty. The existence of a third dimension, evaluation uncertainty, has been suggested but not tested. Evaluation uncertainty promises to resolve

the problem of the less than perfect discriminant validity of the original uncertainty constructs, and is a promising candidate for a third dimension of uncertainty. Finally, implementation uncertainty promises to provide the means for accounting for purchase process-related doubts that are projected prior to the purchase decision.

Our tests suggest that four dimensions of uncertainty, knowledge uncertainty, evaluation uncertainty, choice uncertainty, and implementation uncertainty are the major descriptors of total uncertainty related to consumers' pre-purchase decision process in online markets. Against previous wisdom, evaluation and implementation uncertainties seem to exercise a stronger impact on consumer decisions than the other varieties of uncertainty in the electronic commerce context.

5.3 Implications for practice

Uncertainty is an important factor in consumer behavior. Perceived gaps in one's knowledge motivate search, yet, uncertainty about one's ability to evaluate information will likely impede search for product information. The practical impact of uncertainty is significant. All profitable business is built on managing uncertainty. Expert consumers do not need information or advice. They often don't commit to search but rather reiterate their previous decisions, which have been associated with successful outcomes through experience. Neither are novices likely to search for they lack ability to search and process product information. Consumers somewhere in the middle of these two endpoints are the most prospective targets for advertiser, because their decisions can be influences with the least effort.

On electronic markets, in particularly, it would be beneficial to identify consumers by their uncertainties and direct marketing efforts to address those informational deficiencies most easily influenced. By targeting consumer groups identified through analyzing uncertainties, we believe, resources could be most efficiently allocated to groups of consumers most susceptible to marketing information (advertising).

Consumption involves decision making; what to buy, where to buy, and when to buy being the most obvious choices to be made. Often consumers face these decisions without being fully informed about the many aspects of the purchase. Indecision may exist over the best choice alternative. Gaps in one's knowledge lead to feelings of insecurity, a mental state that is often termed uncertainty. Alba and Hutchinson (2000) note that "the correspondence between self-assessed and actual validity of knowledge is an important issue for the study of consumer decision making.

Understanding the sources of uncertainty related to consumer decisions and information quality is a key to serving the customer better. As a research topic, uncertainty is gaining on importance, especially for electronic retailing relies on human-to-computer interaction, which offers little on-the-spot adaptation to varying consumer needs.

Our tests suggest that the iterative search process leads consumers to the most satisfied purchase. It seems that we should develop the search agents to help consumers engage in iterations while searching information from different sources. Nowadays most search agents are used to compare price, but not the quality of products. Still, it seems that the quality of product is the most important characteristic for consumers when they estimate their satisfaction on purchase.

5.4 Limitations

5.4.1 Limitations of the observation study

Not all purchase decisions are alike. Some decisions are preceded by a more lengthy deliberation process than others. At the more extensive extreme lie decisions such as buying a home. The greater the distance of the steps in the decision process the more diverse will the role of information sources become. As the decisions grow in complexity social information sources will become increasingly important and that mix of different types of information sources may result in decision processes and outcomes rather unlike the ones depicted in papers I and II. Therefore, to generalize our findings to purchase decisions at large, it would be necessary to test them against purchase processes involving decisions of higher complexity and longer periods of deliberation and different product categories.

5.4.2 Limitations of the survey study

Data were collected in the specific context of a travel purchase. We were forced to put the questions of uncertainty in some concrete context, so that consumers could be able to imagine their feelings and, thus be able to answer our questions. There might be some problems in generalization of results.

Our sample consists of Finnish citizen, who are used to advanced technology, well educated, and well-being. We obtained a higher percentage of samples from 30 to 79 years old than found in the population and we obtained more men than in population, but we might assume that our data

corresponds to the current population of active Finnish internet users quite well. There might be some problems in generalization of our results.

The decision making approach is useful to understand consumer buying behavior when the purchase is a real decision making situation, however, when a purchase is small or otherwise unimportant to the buyer, it does not apply. In many cases earlier experience and habits may dominate decisions. Similarly, if the purchase is relatively big and important for the buyer it may have some limitations. For example, if a consumer is buying a house, the process may have many characteristics that link it merely to a learning process. In some cases when the buying decision is dependent on many decision makers, negotiation processes might be suitable.

5.5 Future research

I would like to future study and test to validate the uncertainty measurement instrument with different product categories and different data sample from other location of residence and country than Finland.

It would be useful and fruitful to test both the consumer online pre-purchase search behavior and uncertainty measurement items and scales in different kind of decision making and buying situations: A small purchase, purchase in medium difficulty rate and a relatively big purchase situation.

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6. Appendices

Appendix 1: Main References Used in This Dissertation

Appendix 2: Semi-structured observation questionnaire

Appendix 3: Survey Questionnaire

Appendix 1: Main References Used in This Dissertation

Theory of Decision making phases	• **Simon, H. 1982.** *Models of Bounded Rationality*." • **Herbert Simon´s theory** of decision making Phases 1979, "Rational decision making "
Uncertainty affect consumer pre-purchase and buying behavior	• **Stigler 1961**, Economics of information Theory (EOI) • **Lanzetta (1963).** Information Acquisition in Decision-Making. • **Lanzetta and Driscoll (1968)"**Effects of uncertainty and importance on information search in decision making. • **Urbany (1986).** "An Experimental Examination of the Economics of Information." • **Urbany, Dickson and Wilkie (1989).** "Buyer Uncertainty and Information Search." • **Moorthy, Ratchford and Talukdar(1997)"**Consumer information search revisited: Theory and empirical analysis." • **Kahneman and Tversky 1979:** prospect theory: An analysis of decision making under risk • **Howard and Sheth´s Theory** of buyer behavior 1969 • **Bettman 1979,** An information processing theory of consumer choice • **Einhorn and Hogarth (1981).** "Behavioral Decision Theory: Processes of Judgment and Choice." • **Bettman, Luce and Payne (1998):** Constructive consumer choice processes • **Bettman, and Park 1980,"**Effects of Prior Knowledge and Experience and Phase of the Choice Process on Consumer Decision Process" • **Park and Lessig (1981)** "Familiarity and Its Impact on Consumer Decision Biases and Heuristics." • **Kiel and Layton (1981)** "Dimensions of Consumer Information Seeking Behavior • **Newman and Staelin(1972)** "Prepurchase Information Seeking for New Cars"
Uncertainty versus Knowledge (the two sides of a coin)	• **Alba and Hutchinson (1987)** "Dimensions of consumer expertise" • **Brucks (1985)** "The Effects of Product Class Knowledge on Information Search Behavior • **Fiske, Luebbehusen, Miyazaki and Urbany (1994)**The Relationship between Knowledge and Search. • **Beatty and Smith (1987)** "External Search Effort: An Investigation Across Several Product Categories • **Park and Lessig (1981)** "Familiarity and Its Impact on Consumer Decision Biases and Heuristics." • **Punj, and Staelin (1983)** "A Model of Consumer Information Search for New Automobiles." • **Schmidt and Spreng (1996)** "A proposed model of external consumer information search." • **Srinivasan, and Ratchford (1991).** "An Empirical Test of a Model of External Search for Automobiles."

Appendix 2: Semi-structured observation questionnaire

INFORMATION SEARCH **INTERVIEW Data of one pupil**

Name_____

sex ☐ female ☐ male

Age _____years

Have you internet at home ☐ yes ☐ no

How many hours you use internet in a week? _____hours

Have you used a search engine before ? ☐ yes ☐ no

How many times per month/week/day you use search engine?

_____

Have you bought in the internet? ☐ yes ☐ no

How often you buy in the internet? (times per month/week/day)

_____

Have you compared prices in the internet? ☐ yes ☐ no

How often you compare prices in the internet? (times per outh/week/day)

_____

How many music internet-sites you know? _____pcs

How many search engines you know? _____pcs

How many internet music stores you know? _____pcs

How many music bands or singers home sites you know? _____pcs

How well do you think you can use the search engines? The scale is from 4 to 10

___

How well do you think you can search music information in the internet?

___

Measurements:

NSS: Number of different stores shopped

NBC: number of different brands/alternatives considered in the appliance purchase

Trade: number of trade sources consulted

AST: actual shopping time

Price

Number of attributes

Where to start seeking, Where to buy

Task 1: seek a christmas present for your grandmother (What kind of music-cd would your grandmother really like?)

Where he/she begins?
☐search engine site ☐internet portal ☐internet store ☐band homesite ☐ search agent ☐ other name/address of the site
_____

How he/she goes forward?
☐search engine site ☐internet portal ☐internet store ☐band home site ☐ search agent ☐ other name/address of the site_____

IF pupil have a problem to go forward ...
☐he/she is in a right internet site, but can´t use the service

He/she can´t go forward and you give her/him a hint, which one
☐search engine site ☐internet portal ☐internet store ☐band homesite ☐ search agent ☐ other name/address of the site
_____

How many commercial places he/she visits? Number of trade sources consulted _____pcs
Number of different brands/alternatives considered in the appliance purchase _____pcs

How many attributes he or she compares altogether

Price	_____pcs	brand name	_____pcs
availability	_____pcs	listening	_____pcs
list of CD-records	_____pcs	else, what	_____pcs
singles	_____pcs	_____	

Where to buy
☐search engine site ☐internet portal ☐internet store ☐band homesite ☐ search agent ☐ other name/address of the site
_____

The name of the CD:_____

Ask pupil: What is the price of the purchase _____euros
The real price inc. tax and delivery costs _____euros
Did he/she notice the difference? ☐ yes ☐ no

Search process was
☐ simultaneous ☐ sequential ☐ iterative

Used time per task?
AST: actual shopping time _____ minutes _____second

Task 2 Buy a Red Hot Chili Peppers "By the way"-cd for your friend

Where he/she begins?
☐search engine site ☐internet portal ☐internet store ☐band homesite ☐ search agent ☐ other name/address of the site
_____

How he/she goes forward?
☐search engine site ☐internet portal ☐internet store ☐band home site ☐ search agent ☐ other name/address of the site_____

IF pupil have a problem to go forward ...
☐he/she is in a right internet site, but can´t use the service

He/she can´t go forward and you give her/him a hint, which one
☐search engine site ☐internet portal ☐internet store ☐band homesite ☐ search agent ☐ other name/address of the site
_____

How many commercial places he/she visits? Number of trade sources consulted _____pcs
Number of different brands/alternatives considered in the appliance purchase _____pcs

How many attributes he or she compares altogether

Price	_____pcs	brand name	_____pcs
availability	_____pcs	listening	_____pcs
list of CD-records	_____pcs	else, what	_____pcs
singles	_____pcs	_____	

Where to buy
☐search engine site ☐internet portal ☐internet store ☐band homesite ☐ search agent ☐ other name/address of the site
_____

The name of the CD:_____

Ask pupil: What is the price of the purchase _____euros
The real price inc. tax and delivery costs _____euros
Did he/she notice the difference? ☐ yes ☐ no

Search process was
☐ simultaneous ☐ sequential ☐ iterative

Used time per task?
AST: actual shopping time _____ minutes _____second

Task 3: Buy a CD you like for your self

Where he/she begins?
☐search engine site ☐internet portal ☐internet store ☐band homesite ☐ search agent ☐ other name/address of the site
_____

How he/she goes forward?
☐search engine site ☐internet portal ☐internet store ☐band home site ☐ search agent ☐ other name/address of the site_____

IF pupil have a problem to go forward ...
☐he/she is in a right internet site, but can´t use the service

He/she can´t go forward and you give her/him a hint, which one
☐search engine site ☐internet portal ☐internet store ☐band homesite ☐ search agent ☐ other name/address of the site
_____

How many commercial places he/she visits?
Number of trade sources consulted _____pcs
Number of different brands/alternatives considered in the appliance purchase _____pcs

How many attributes he or she compares altogether

Price	_____pcs	brand name	_____pcs
availability	_____pcs	listening	_____pcs
list of CD-records	_____pcs	else, what	_____pcs
singles	_____pcs	_____	

Where to buy
☐search engine site ☐internet portal ☐internet store ☐band homesite ☐ search agent ☐ other name/address of the site
_____

The name of the CD:_____

Ask pupil: What is the price of the purchase _____euros
The real price inc. tax and delivery costs _____euros
Did he/she notice the difference? ☐ yes ☐ no

Search process was
☐ simultaneous ☐ sequential ☐ iterative

Used time per task?
AST: actual shopping time _____ minutes _____second

After three tasks:
NSS: Number of different stores shopped altogether _____

Price of the basket altogether _____euro

At the end of search process, where there iterative parts ☐yes ☐no

How much time he/she used altogether AST: actual shopping time _____
Did he/she the tasks properly ☐yes ☐no

Appendix 3: Survey Questionnaire

Helsinki School of Economics and Business Administration
Information System Sciences

Travel services survey questionnaire

We thank you beforehand for answering. Every response is really important for us!

After having answered the questions, please return this form using the reply envelope.

Answer the questions by ticking the response that best suits you [ ], additionally you may provide further details in the_____spaces. thank you!

Every respondent are able to participate the lottery for the travel services gift certificate.

If you are willing to participate the lottery, please write your contact information to cover letter and attach it to the reply envelope. All contact information handles separately from the survey questionnaire. The information will not be used to any other purpose than the lottery.

Part 1 Demographic information

1. Your gender

[ ] Female [ ] Male

2. Year of birth _____

3. Education*(Please tick only the highest level attained)*

[ ]Primary school/ Junior High School
[ ] High School / Matriculation examination
[ ] Vocational college
[ ] College graduate
[ ] University graduate

4. Residential community, Post code_____

[ ] Helsinki, Espoo, Vantaa or Kauniainen
[ ] Other city with population over 45000
[ ] Other city with population under 45000
[ ] Urban community other than city
[ ] Rural area
[ ] I don´t know

5. How many persons live with you in the same household?

[ ] I live by myself
[ ] I live together with ____ adults and ____ under 7-year-old and ___7-18- year old persons

6. Your annual income

[ ] Under 3000 euro
[ ] 3000 - 4999 euro
[ ] 5000 - 9999 euro
[ ] 10000 - 13999 euro
[ ] 14000 – 19999 euro
[ ] 20000 - 24999 euro
[ ] 25000 – 29999 euro
[ ] 30000 – 39999 euro
[ ] 40000 – 49999 euro
[ ] 50000 – 59999 euro
[ ] 60000 – 79999 euro
[ ] over 80000 euro

Part 2 Internet usage

7. a) I have used internet since year of_____.
b) I use internet _____ hours weekly, _____ days every week,
of which the e-mail usage is _____ hours weekly**.**

8. a) How would you grade your skills of using the Internet (using the school grading 4-10)?_____
b) How would you grade your skills of searching the information on the Internet (4-10)?_____
c) How would you grade your skills of searching and comparing travel services (4-10)?_____

9. a) How many times you have bought something on the internet in the last year? _____times

b)What is your latest purchase on the Internet?_____

10. When you did your latest purchase on the Internet...

a) Where you begin to *search* the product?

[ ] an inexpensive Internet Store
[ ] the Internet Store, where the brand is well represented
[ ] a familiar storekeeper or a familiar internet store, where you are a regular customer
[ ] other

b) Where you bought the product?

[ ] an inexpensive Internet Store
[ ] the Internet store, where the brand is well represented
[ ] a familiar storekeeper or a familiar Internet store, where you are a regular customer
[ ] other

11. Imagine a situation where you are buying yourself holiday travel arrangements.. You have already decided on the destination, hotel, dates, and travel services provider. Over telephone a travel agent tells you that the vacation will cost 530 euro. Friends that you trust tell of having found the same vacation through the WWW for 50 euro less, however, they cannot remember address of the seller. How much time would you be willing to spend to locate that particular seller on the WWW? _____hours___minutes.

12. Imagine a situation where you are buying yourself an airline ticket. You have already chosen the destination, airline, and dates. Over telephone a travel agent tells you that the ticket will cost 500 euro. You know that a cheaper ticket can be purchased from a web merchant. based on your experience, it will take one hour of your own time to find the www- pages of the cheaper source, register on the service, booking the flight, and paying for the ticket. How much cheaper should the ticket be, for you to buy it from the web merchant? I should get the ticket _____euro cheaper

Part 3 Searching and purchasing your latest trip

13.a) How many journeys to destination outside Finland that included at least one overnight stay did you make during past five years? Please indicate only those journeys that you bought yourself or that were bought to you so that you could influence the choices made.

[ ] I have made _____journeys in past five years

[ ] I have not made any journeys that fir the above description(if you select this alternative, please move ti the end of this questionnaire)

b) When did you make the journey? Year _____Month_____

14. How would you describe your latest journey?

[ ] A cruse on a sea bordering Finland [ ] a flight + hotel combination

[ ] a packaged vacation/ group travel [ ] I bought flight and hotel from different places

[ ] Other trip abroad_____

15. a) How many persons travelled with you?

[ ] I travelled alone [ ] I travelled in the company of _____adults and _____persons under age of 7 and ____ 7-18 year- old persons

b) How you chosen the trip? _____alone _____all together

16. How often you made comparable trips?

[ ] once a month [ ] twice a year

[ ] once a year [ ] once in a three years [ ] Seldom

17. When you started to search the journey?

[ ] 6 months before the trip [ ] Less than a month before the trip

[ ] 1-6 months before the trip[ ] less than a week before the trip [ ] When?_____

18. Please indicate, in order of importance, those information sources listed below that you used when choosing this journey
(Most important= 1, second important=2, etc..If in your opinion some two alternatives were equally important, you may mark them with the same number. Do not tick an alternative that you did not use.)

Conventional sources

[ ] Own experience

[ ] Relatives/friends

[ ] Travel agency

[ ] Service provider

[ ] Brochure

[ ] Telephone service

[ ] Advertisement

Internet

[ ] E-mail

[ ] Travel agency, www-store

[ ] Service providers www-page

[ ] Internet comparing agent

[ ] Internet search engine

[ ] Persons home page

[ ] chat

[ ] Other, what_____

19. When you were choosing your last journey, how important you find the following characteristics? Please share 100 points to them.

_____ Low Price

_____ High quality

_____ Need to find the itinerary quickly

_____ Ease of transaction

_____ Well known Brand

_____ Previously known seller or merchant

_____ Friends recommendation

_____ Other, what?_____

20. Searching and comparing your latest journey

a) How many physical stores you visited?	pcs
b) How many internet stores you visited?	pcs
c) How many alternatives you compared?	pcs
d) How many brands you compared?	pcs
e) From how many stores you bought your journey?	pcs
f) How much time you used all together?	hours

21. Please indicate and tick those attributes you find out when purchasing you latest trip

[ ] Time of departure
[ ] Place of departure
[ ] Flight duration
[ ] nonstop flight
[ ] Airline
[ ] seats in plane
[ ] Meals included to flight
[ ] Special meals
[ ] Transportation to hotel
[ ] Distance to beach
[ ] Distance to airport
[ ] Distance to town
[ ] Transportation in destination
[ ] Special needs for wheelchair
[ ] Money exchange
[ ] Weather in destination
[ ] What kind of destination
[ ] Population in destination
[ ] guide services
[ ] Passport/ visa requirements
[ ] Car rental
[ ] where hotel is in the destination
[ ] Hotel
[ ] room, bungalow, cabin
[ ] Room size
[ ] which floor
[ ] elevator
[ ] Reception
[ ] Balcony, terrace
[ ] sea view/ garden view
[ ] Swimming pool
[ ] Children´s pool
[ ] Bar/ restaurant in hotel
[ ] additional bed
[ ] Air condition, television
[ ] Which meals are included
[ ] guided tours
[ ] babysitter
[ ] evening program
[ ] Hobbies
[ ] distance to hobby
[ ] Other, what?_____

22. How you think about purchasing your latest trip?

	Totally disagree ⇩						Totally agree ⇩
I was forced to seek a lot of information to be able to compare, choose and purchase a product	☐	☐	☐	☐	☐	☐	☐
Purchasing consist a lot of uncertainty	☐	☐	☐	☐	☐	☐	☐

23. What did you think, when you began to search your latest trip?

	⇩uncertain						certain ⇩
I had uncertainty of my own knowledge about the alternatives	☐	☐	☐	☐	☐	☐	☐
I had Uncertainty about my decision criteria to conduct my choice	☐	☐	☐	☐	☐	☐	☐
I was uncertain of which product to choose	☐	☐	☐	☐	☐	☐	☐
I was uncertain of being able to purchase the product I have chosen already in my mind	☐	☐	☐	☐	☐	☐	☐

24. When you think back the time you were choosing your latest trip….

a) Did you feel uncertain to find the travel information?

	Totally disagree ⇩						Totally agree ⇩
Uncertainty of having enough information about trips	☐	☐	☐	☐	☐	☐	☐
Uncertainty about the different alternatives	☐	☐	☐	☐	☐	☐	☐
Uncertainty about the prices of trips	☐	☐	☐	☐	☐	☐	☐
Uncertainty about different trips	☐	☐	☐	☐	☐	☐	☐
Uncertainty about where is the lowest prices	☐	☐	☐	☐	☐	☐	☐

b) Did you feel uncertain to compare trips?

	Totally disagree ⇩						Totally agree ⇩
Uncertainty of the main criteria on my choice	☐	☐	☐	☐	☐	☐	☐
Uncertainty of which attributes are the criteria	☐	☐	☐	☐	☐	☐	☐
Uncertainty of the most important criteria	☐	☐	☐	☐	☐	☐	☐
Uncertainty of own ability to compare information	☐	☐	☐	☐	☐	☐	☐
Uncertainty of comparability of the information	☐	☐	☐	☐	☐	☐	☐
Uncertainty of availability of comparable information	☐	☐	☐	☐	☐	☐	☐

c) Did you feel uncertain in choosing your trip?

	Totally disagree ⇩						Totally agree ⇩
Uncertainty of having difficulties to choose trip	☐	☐	☐	☐	☐	☐	☐
Uncertainty of having problems to go to the store	☐	☐	☐	☐	☐	☐	☐
Uncertainty of trip availability at purchase time	☐	☐	☐	☐	☐	☐	☐
Uncertainty of having difficulties to choose where to shop	☐	☐	☐	☐	☐	☐	☐

d) When you have chosen your trip, did you feel uncertain to be able to buy your trip?

	Totally disagree ⇩						Totally agree ⇩
Uncertainty of having problems in purchasing	☐	☐	☐	☐	☐	☐	☐
Uncertainty of having problems to go to the store	☐	☐	☐	☐	☐	☐	☐
Uncertainty of product availability at purchase time	☐	☐	☐	☐	☐	☐	☐
Uncertainty of fulfilment of delivery of the trip	☐	☐	☐	☐	☐	☐	☐
Uncertainty of having problems in purchasing the trip	☐	☐	☐	☐	☐	☐	☐
Uncertainty of fulfilment on delivery price	☐	☐	☐	☐	☐	☐	☐
Uncertainty of fulfilment of adds promised delivery	☐	☐	☐	☐	☐	☐	☐

25. What is your opinion on following statement regarding your latest trip

	Totally disagree ⇩						Totally agree ⇩
Trip was an important purchase	☐	☐	☐	☐	☐	☐	☐
Trip was a complex purchase	☐	☐	☐	☐	☐	☐	☐
Trip includes many parts	☐	☐	☐	☐	☐	☐	☐
Trip was an expensive purchase	☐	☐	☐	☐	☐	☐	☐

26. How the following statements describe your latest trip as a purchase?

	Totally disagree ⇩						Totally agree ⇩
There are plenty of alternative trips	☐	☐	☐	☐	☐	☐	☐
There were few suitable trips for me	☐	☐	☐	☐	☐	☐	☐
There were a large difference between alternatives	☐	☐	☐	☐	☐	☐	☐
There were a large price dispersion	☐	☐	☐	☐	☐	☐	☐
Easy to buy	☐	☐	☐	☐	☐	☐	☐
I did use a lot of time	☐	☐	☐	☐	☐	☐	☐
I was in a hurry	☐	☐	☐	☐	☐	☐	☐
I must justify to others	☐	☐	☐	☐	☐	☐	☐
I knew beforehand, where to shop	☐	☐	☐	☐	☐	☐	☐
I knew beforehand, which trip to buy	☐	☐	☐	☐	☐	☐	☐

27. Which of following alternatives describes best your search behavior*?*

[ ] Sequential search (I searched and evaluated each of trip as a whole entity before going on to the next alternative)

[ ] Simultaneous search (I searched trips with search agent, I compared several alternatives in the same time)

[ ] Iterative search (I searched and evaluate each trip before moving to next alternative and I returned back to earlier alternative.)

28. Are you satisfied with your latest trip?

	Totally disagree ⇩						Totally agree ⇩
I am satisfied the way I choose the trip	☐	☐	☐	☐	☐	☐	☐
I am satisfied with the trip	☐	☐	☐	☐	☐	☐	☐
I am satisfied with the price of the trip	☐	☐	☐	☐	☐	☐	☐
I could not find any better trip, fast seeking more	☐	☐	☐	☐	☐	☐	☐

29. What is your opinion about the following statements about seeking travel information?

	Totally disagree ⇩						Totally agree ⇩
I aim to search travel information in internet	☐	☐	☐	☐	☐	☐	☐
Next time, I would search travel information in internet	☐	☐	☐	☐	☐	☐	☐
I believe to be more interested to search travel information in internet	☐	☐	☐	☐	☐	☐	☐
It is a good idea to seek travel information in internet	☐	☐	☐	☐	☐	☐	☐
It is rational to look after travel information in internet	☐	☐	☐	☐	☐	☐	☐
I like to search travel information in internet	☐	☐	☐	☐	☐	☐	☐
It is convenient to search travel information in internet	☐	☐	☐	☐	☐	☐	☐
I know many people searching travel information in internet	☐	☐	☐	☐	☐	☐	☐
I have heard about using internet as a travel information source	☐	☐	☐	☐	☐	☐	☐
I have seen advertisement of internet as travel information source	☐	☐	☐	☐	☐	☐	☐
I will buy my trip from familiar store	☐	☐	☐	☐	☐	☐	☐
It is a good idea to buy from familiar store or merchant	☐	☐	☐	☐	☐	☐	☐
It is a good idea to compare prices from many stores	☐	☐	☐	☐	☐	☐	☐
It is a good idea to use plenty of information sources	☐	☐	☐	☐	☐	☐	☐
I am used to search travel information in conventional sources	☐	☐	☐	☐	☐	☐	☐
I have not consider to search trips in internet	☐	☐	☐	☐	☐	☐	☐
I have not considered to buy trips in internet	☐	☐	☐	☐	☐	☐	☐
I do not like to search information from sources I has not used before	☐	☐	☐	☐	☐	☐	☐
It is easy to learn to search travel information in internet	☐	☐	☐	☐	☐	☐	☐
It is easy to search travel information in internet	☐	☐	☐	☐	☐	☐	☐
it is effortless to search travel information in internet	☐	☐	☐	☐	☐	☐	☐
it is simple to search travel information in internet	☐	☐	☐	☐	☐	☐	☐
It is faster to search travel information in internet	☐	☐	☐	☐	☐	☐	☐
it is easy to search travel information in internet	☐	☐	☐	☐	☐	☐	☐
It is effective to search in internet	☐	☐	☐	☐	☐	☐	☐
It is useful to search in internet	☐	☐	☐	☐	☐	☐	☐
I am able to find inexpensive trips in internet	☐	☐	☐	☐	☐	☐	☐
There is enough information in internet	☐	☐	☐	☐	☐	☐	☐
I feel Information in internet trustworthy	☐	☐	☐	☐	☐	☐	☐
Internet is suitable for me to seek travel information	☐	☐	☐	☐	☐	☐	☐
Internet is suitable for me as information source	☐	☐	☐	☐	☐	☐	☐
It is suitable for me to choose travel from internet	☐	☐	☐	☐	☐	☐	☐
I am used to search information in internet	☐	☐	☐	☐	☐	☐	☐
Persons I respect, recommend internet as information source	☐	☐	☐	☐	☐	☐	☐
My relative and friends have search information in internet	☐	☐	☐	☐	☐	☐	☐

Thank You !

If you wish to comment this questionnaire or give feedback to its organizers, please write your opinions on the space below, thank you.

If any question arise that you wish to have answered before you complete this form, please contact research group at Helsinki School of Economics by e-mail: matkys@hkkk.fi or by mail : Helsinki School of Economics, PL 1210, 00101 Helsinki

Part II: Original Essays

Essay 1:
Lauraéus-Niinivaara Theresa, Saarinen Timo, and Öörni Anssi. Knowledge and Choice Uncertainty Affect Consumer Search and Buying Behavior. HICSS Conference paper 3-6. January 2007.

Essay 2:
Lauraéus-Niinivaara Theresa, Saarinen Timo, Sunikka Anne, and Öörni Anssi. Relationship between Uncertainty and Patterns of Pre-purchase Consumer Search in Electronic Markets. HICSS Conference paper 7-10. January 2008.

Essay 3:
Korhonen Pekka, Lauraéus Theresa, Saarinen Timo, and Öörni Anssi. Uncertainty in Consumer Decisions. Aalto University School of Economics. Department of Information and Service Economy.

Essay 4:
Lauraéus-Niinivaara Theresa. Uncertainty is the Other Side of the Coin of Information Online Search. HICSS Conference paper 5-8. January 2010.

Essay 5:
Korhonen Pekka, Lauraéus Theresa, Saarinen Timo, Öörni Anssi. Impact of Online Pre-purchase Search on Consumer Satisfaction. Aalto University School of Economics. Department of Information and Service Economy.

Knowledge and Choice Uncertainty Affect Consumer Search and Buying Behavior

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Abstract

Pre-purchase search is an activity which most consumers engage in frequently to extract up-to-date information for a purchase decision. Search is an interesting topic from the practical and academic point of view. We approach the topic by observing the information needs through the concept of uncertainty. Uncertainty is the driving force of consumer search. Search is costly and, thus, no search would be likely to occur if consumers had a perfect knowledge about their preferences and market offerings. While uncertainty is widely acknowledged as the driving force of search, few attempts have been made to relate uncertainty and the choice of pre-purchase information.

We studied the generic types of consumer pre-purchase uncertainty: knowledge uncertainty and choice uncertainty, and the connection between uncertainty dimensions and the extent of the search process. Our findings suggest that the aforementioned uncertainties markedly affect the consumer search process and are useful determinants of consumer behavior in pre-purchase deliberation.

1. Introduction

The study of consumer choice and decision processes has been an active topic in consumer behavior research for over 30 years [26], [40], [19], [7]. While pre-purchase search has received considerable academic attention during the decades it is still a high priority topic and even gaining in importance recently for increasing internet penetration dramatically expands many markets and allows consumers to change their information search behavior. Consumer information search has been the focus of numerous articles in the consumer behavior, economics, and marketing literature over the past three decades [5], [36],[41],[29]. In recent decades, there have been many investigations into consumer search behaviour in a digital environment [2],[3],[4], [9], [10], [12], [18], [20], [21], [23], [24], [25], [29], [32], [33], [36], [43], [49], [52], [53], [54], [55] in the context of search attributes [12],[34],[28],[13] and media interactivity [2],[28]. Recently, there has been research into internet-based market efficiency [10], [53], [54], [55], price sensitivity [34], [13] and search costs [2],[3],[34],[18],[52]. In a digital environment consumer information pre-purchase and search behavior is going to be different from the traditional search behaviour [2], [3], [10], [12], [13], [17], [33], [44], [53], [54], [55]. Jansen and Pooch 2001 [22] report that the internet seekers use different search characteristics to traditional seekers.

For many people, searching on Internet is increasingly a daily behaviour. Search engines have become essential way and first choice to seek information for many people [24]. There is a plenty of research studying the use of web search engines [20],[22],[20],[37],[44].

The Internet has made enormous amounts of information available to consumers. While the total amount of information available to consumers increases the ability to absorb, it remains limited leaving many consumers at a loss with purchase decisions. This purchase-related uncertainty has been an active topic for some decades, and especially its effect on the consumer search activity has received much attention [9], [14],[31],[32], [42], [47], [48].

It is a well known fact, that search is frequently executed in relation to purchases [19], [27], [29], [32], [33], [43], [44], [46], [47], [48], [53], [54], [55], yet, consumers tend to limit the search to a handful of products and vendors [3], [53], [54], [55]. The prospective offerings found during the limited search effort form the consideration set, a set of options, one of which will be purchased. It is not surprising that both practitioners and academics are constantly trying to advance their knowledge about the determinants of consumers including a certain offering into their

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consideration set, since that is what keeps the sellers in business.

Information sources used by the consumers while searching for information, are of central interest to most businesses. The relative advantage of various consumer information sources is the topic of this paper. At present, consumers have a number of different sources at their disposal. Conventional sources, such as outdoors and in-store advertising, newspaper and magazine advertisements, radio and television commercials, brochures, and direct selling have been complemented during the last decade by information sources implemented using the Internet technology. These new sources are typically built on the World-Wide Web and are often coined 'electronic channels' or 'network channels'. The question that has permeated the post Internet frenzy in electronic commerce is the effectiveness of electronic retailing outlets in persuading consumers.

Pre-purchase information search is often seen as a means to lessen decision-related uncertainty. Therefore, keeping other determinants constant, greater uncertainty should lead to more extensive search behavior [31]. However, many researchers, have also argued that there may be certain conditions, under which uncertainty reduces, instead of increasing, search [1], [7], [8], [50].

The extent of search is an important topic since consumer search is one of the most important mechanisms that check market prices. Search is costly and, hence, consumers may not engage in extensive search, if uncertainty negatively affects their perception of the outcome of the search. These search costs are mostly in terms of the cost of the time spent searching: Time is more valuable for the "rich" than for the "poor". Rich customers are therefore said to be "high cost," and "poor" customers are said to be "low cost". Other things being equal, the former should search less than the latter. According to Alba et al. (1997) the total cost of a search activity are both "monetary and nonmonetary expenditure" [2]. The monetary cost is dependent on the consumer's income. Hence, different consumers will assign different costs to a search activity irrespective of the absolute financial costs of the search [41],[47]. Alba et al. [2] defines the non-monetary costs to be in the form of the time, inconvenience and difficulties in carrying out the search activity (Stigler, 1961).). In general for most products, we can expect to have lower search costs on the Internet [2], [3], [34], According to Jansen the sponsored search mechanism is important to finance the search engines to be able to offer "free" search [24], [23]. Search costs are influenced by variables such as a consumer's experience or knowledge [36] and the uncertainty or perceived risks faced by the consumer [45], [47].

Uncertainty is a complex topic, and even the proper conceptualization of uncertainty is still disputed. The early studies of uncertainty suggested two types of uncertainties linked to purchase decisions [6], [7], [31], [42], [46], [50]. These varieties were labeled "Knowledge uncertainty" and "Choice uncertainty". Urbany et al. [48] found support for the effects of knowledge and choice uncertainty on consumer decisions and linked them. What is, however, missing, is a comprehensive framework to tie the various uncertainties firmly to consumer decision making. The constructs of uncertainty will have to be defined more closely and their hypothetical relevance in consumer decisions more rigorously validated. Further, few studies have investigated the effect of uncertainty on consumer search processes - Lauraeus-Niinivaara et al. [32], [33] and Whinston [49] being the exceptions. There is lack of evidence about the connection between consumer search processes and uncertainty.

In this paper, we will study the validity and the structural relationship of the uncertainty constructs and their effect on consumer search processes and pre-purchase search behavior. In our empirical study in May 2004, we observed and wrote down how consumers really search and buy on the Internet. In the uncertainty research area, many cases of earlier studies have been based on the questionnaire research method.

We researched the general types of uncertainty: the choice uncertainty (CU) and knowledge uncertainty (KU) the a case of consumers, who have very little experience of information search and who do not have "already-learned" search behavior. In this study, we examine the structural relationships among the uncertainty constructs and their effects on information search. The implications of the findings for previous research on the relationship between uncertainty and search are discussed, along with the research directions.

2. Consumer search

2.1 Price search

Historically, the first studies of markets with imperfect information considered situations in which buyers are badly informed about sellers´ prices. It is natural, therefore, to first consider the behavior of consumers under price uncertainty. The seminal paper on price search is Stigler´s (1961) The Economics of Information. Stigler [46] starts by emphasing the fact

that price dispersion is ubiquitous even for homogenous goods. Suppose then, for the sake of clarity, that the consumer faces a distribution of prices for the same good on a local market and tries to find the retail outlet that charges the lowest price.

Suppose, further, that the consumer knows the distribution of prices but has no means of knowing, without searching, which outlet charges the lowest price. The problem then is to determine how long he or she will search before buying – that is, how many sellers he or she will canvas, given that search has a cost in time and lost earnings and that, after some point, to continue the search may be more costly than the gain that is to be expected from it. Stigler models this search (visit to another retail outlet) as a drawing from a particular random distribution (a normal and a uniform distribution, in fact), and argues that consumers will visit a fixed number, n, of stores and then buy from the store with the lowest price.

2.2 The cost of information

Consumers are supposed to maximize their "consumer surplus," that is, the difference between the utility of a good expressed in monetary units – the "reservation price" – and its selling price. On the simplifying assumption that each customer buys at most one unit, he or she will choose the brand and the shop that gives the highest surplus and thus wishes to know which shop sells a given brand at the lowest price. But what if the consumer does not know which shop sells at which price? He or she will then have to use some a priori knowledge, based on past personal experience and common knowledge. For example, a probability distribution of the prices in a shopping area (a town for example) may be common knowledge: Expensive high-quality shops are known to be located in particular streets; low- quality inexpensive brands are known to be available in some department stores.

Getting information on prices charged for particular brands by particular shops then involves the cost of information, which depends on the information technology (the existence of consumer reports, specialized journals, advertising, etc.), the number of brands and shops available and one´s a priori knowledge. In a loose way, perfect information is something equated with the zero cost of information. This makes sense if one means to say that perfect information can be obtained at zero cost. When the costs of information are positive, then information is imperfect in the sense that the customer must compare the marginal cost of an additional piece of information with the expected marginal gain terms of increased surplus, and some may thus be led to stop searching before than lowest price is found, even if by paying the cost perfect information can be obtained. the managerial cost of search is often assumed to be constant in order to simplify things and because of a lack of empirical and theoretical work on its shape.

2.3 Consumer search in a digital environment

There are two basic dimensions of consumer information search, internal and external. The internal information search construct represents the retrieval of knowledge from memory [2],[16]. The external information search construct represents the motivated acquisition of information from the environment [7], [16] and therefore external search precedes many consumer decisions [7],[41],[5],[39],[43]. The consumer purchase decision process is usually presented as consisting of three phases: pre-purchase, purchase and post-purchase phases. The pre-purchase phase includes need recognition, information search, evaluation of alternatives and product choice [40], [14], [15]. Most of the research into the consumer purchase process has concentrated on developing models that examine which variables influence the search behavior of individuals, and how [9], [28], [43].

The complexity of the consumer decision phenomenon is depicted by a notion that more than 60 determinants have been related to pre-purchase consumer search [43]. Some of the most important ones are: search benefits and costs [46], [38], [30], imperfect information about product quality [38], wealth or income [46], [35], past experience [11], [5], prior knowledge [38], [41], [45], education [26], [39].

3.Information search and decision-related uncertainty dimensions

One reason consumers search for pre-purchase information is to reduce their uncertainty about a decision. Information search is often seen as a mean to lessen decision-related uncertainty. Therefore, greater uncertainty should lead to more extensive search behavior [31]. Some early studies of uncertainty constructs and uncertainty dimensions of "Knowledge uncertainty" and "Choice uncertainty" have been done in the sixties and seventies [6], [46], [31], [42], [50], [7]. However, many researchers, have argued that there may be some certain conditions, under which uncertainty reduces, (instead of increases), search behavior [1], [7], [8], [50].

Urbany et al. [48] have investigated information search in the context of consumer decisions. They identified various forms of decision-related

uncertainty, which are likely to affect the information search in many ways. Consumer researchers have defined uncertainty in many different ways, for example, as perceived risk. Urbany et al. [48] defined uncertainty as the amount of information the buyer brings to the search process. If a consumer receives more information before shopping, he/she will have stronger prior beliefs and, however, less uncertainty, about which store to shop in. This definition is consistent with more traditional conceptualizations of uncertainty [47]. The dimensions of uncertainty, proposed by Urbany et al.(ibid.), provide the central ingredients for our study. We will next define the two uncertainty dimensions found in the previous literature.

We are now proposing a new way to define uncertainty dimensions: Choice uncertainty and Knowledge uncertainty by utilizing consumers´ personally perceived or experienced value criteria for alternatives and attributes. We use here examples for enlightening our ideas.

3.1 Knowledge uncertainty

Knowledge uncertainty (KU) captures doubts consumers have about their own ability to judge sellers and products well enough to execute rational product comparisons. Urbany [47] has defined knowledge uncertainty as uncertainty about the knowledge of the alternatives and variables - what is known about alternatives. The original construct of knowledge uncertainty is from Stigler [46]. Knowledge uncertainty may arise from a lack of factual information about alternative choices and/ or uncertainty over what decision rules are relevant [48]. Knowledge uncertainty may also be related to uncertainty over how to acquire the necessary information to make a choice. In exploratory principle factor analysis Urbany et al. [48] studied how two dimensions of uncertainty affects search behavior. They defined knowledge uncertainty as uncertainty regarding what is known about the alternatives of the specific decision problem.

The negative Knowledge uncertainty effect would be consistent with the cost-benefit theory of search. Therefore, a greater Knowledge might reflect the higher cost of search [7]. The proposed negative relationship between search cost and search is well known [48], [7], [46]. Urbany et al. [48] roughly support these authors' contentions that a lack of (or uncertainty about) product knowledge increases search costs and therefore may reduce search.

High KU is associated potentially with reduced ability to comprehend and efficiently use new information, which makes information search a more difficult process. The link between prior knowledge or expertise, search cost, and search intensity has several proponents [1], [9], [41]. Experts with lower KU and greater prior knowledge about a product, have a greater capacity for learning new information and therefore are more likely to search than non-experts [1]. Consumers might be certain about what model or brand to choose, and at the same time they might be very uncertain about the knowledge they held about a given product class. In fact, consumers with low knowledge about the product category, might experience a more difficult search task than consumers with a high prior knowledge of the product class. Those consumers higher in knowledge uncertainty might search less than those with lower knowledge uncertainty. In sum, if high Knowledge uncertainty cause limited search, the result of that will be both high search costs and a difficulty of assessing the benefits of search [48].

Knowledge uncertainty occurs when the consumer does not know what alternatives are available or what value criteria exist. The consumer does not know if there exists Alternative 1 or Alternative 2 or Alternative 3. Knowledge uncertainty means that consumer does not know (is uncertain) about the available alternatives. An example: The consumer knows that there are travel packages on sale, but he/she does not know what kinds of places, hotels and other alternatives are available. In sum, the consumer does not know the choice–set, which means that they do not know the different alternatives and their attributes.

3.2 Choice uncertainty

Choice uncertainty (CU) means uncertainty about which alternative to choose [47], [48]. The original construct of choice uncertainty is from Lanzetta [31], who found that choice uncertainty increase search activity similarly as his created other construct "response uncertainty" [31], [42]. Lanzetta, influenced by theorists Daniel Berlyne (1960), says that uncertainty occurs when the "choice of the best alternative is equivocal" in the context of resolving a conflict [31].

It is interesting, how the characteristics if a choice set i.e., experienced similarities or differences between the current choices, contribute to choice uncertainty. Information search will be greater when the choice sets are similar, because of the choice uncertainty generated [31]. In conclusion, Lanzetta argues that a bigger uncertainty, and on the other hand, a similar choice alternative set, should result in more executive search. In contrast, Stigler´s Economics of Information theory and cost- benefit

model predicts that a greater similarity between choice alternatives/ choice-set will reduce search, due to lower expected gains from search and presumably lower choice uncertainty [48].

Sieber & Lanzetta [42] predict in their study 1964, consumers with less complex conceptual structures might be more likely to apply well-defined rules to make decisions. They predict that low choice uncertainty may result from poor knowledge of the available choice-set (i.e., poor knowledge of what alternatives are available). According to Sieber & Lanzetta [42], Consumers who utilize simple conceptual structures perceive less information and, therefore, they might experience less choice uncertainty than consumers who utilize complex structures.

Choice uncertainty is more influential than knowledge uncertainty. Choice uncertainty might come from: Firstly, a high level of ignorance about the product or the market place or secondly, a relatively well-informed base of knowledge that suggests that there may be yet undiscovered alternatives [48].

Urbany et al. [48] defined choice uncertainty as uncertainty regarding which alternative to choose. According to them [48], choice uncertainty covers questions such as what and where to buy, and exists as a separate construct in the consumers' mind. They have further proposed that uncertainty related to the selection of the evaluative means may in fact be a separate entity. In their study, they found that choice uncertainty increases search behavior. Choice uncertainty means that a consumer knows different alternatives, but he/she is confused, because he/she does not know which alternative gives him/her better value and which alternative criteria or attribute of the product is giving the greater benefit for him/her: alternative 1, alternative 2 or alternative 3. The consumer is not actually willing to buy the product, but instead of that, the utility or benefit the product brings. (For example, consumers are not willing to buy a refrigerator, but they are willing to have their food cold and to be longer fresh). An example of the situation: there is no perfect choice (alternative and attribute set) in the product categories of his/her budgeted limited choice set. So the choice problem is to choose one of these imperfect alternatives. The problem of consumers is in the form of which one to choose? Which alternative gives better utility or benefit or satisfaction for him/her? If the consumer does not know which alternative to choose - he/she has choice uncertainty.

3.3. Uncertainty affects consumer search and buying behavior

In the article "Buyer Uncertainty and Information Search", Urbany, Dickson and Wilkie [48] found in 1989 that choice uncertainty (CU) increases search behavior while knowledge uncertainty (KU) reduces search. They found a strong relationship between CU and KU, and according to them, consumers can be high in Knowledge uncertainty yet low in choice uncertainty and vice versa. Therefore, it is possible that high KU may not always lead to high CU and greater search, even though CU and KU are positively related. High KU is associated potentially with a reduced ability to efficiently use new information, which makes information search a more difficult process. The lack of (or uncertainty about) product knowledge increases search costs and therefore may reduce search.

According to Urban, Dickson and Wilkie's three interesting results emerged; Firstly, KU and CU are very strongly related. Secondly, the simple correlations indicate that both CU and KU are positively related to search behavior, although the correlations for KU are smaller. Thirdly, the regression and discriminant analysis results indicate that KU and CU both have significant effects on search, but the CU X KU interaction does not.

In the light of these findings, it becomes apparent that it might be useful to study the relationship between uncertainty measures and consumer search, pre-purchase and buying behavior.

4. Method

4.1 Observation research

The effect of individual differences and purchase situations on search behavior is complex, often interactive and difficult to interpret and generalize about [48]. Therefore, we chose as similar and consistent a group as possible for our observation research. Our response group consisted of 12-15 year old teenagers from the same demographic area. Our observation situation was the same for every respondent, interactive purchase via Internet without time limits.

The method used in this study is empirical observation. We chose this method in order to find out what people really do in a search and purchase situation, instead of just asking what they think they would do. The more specific description of our method is in our working papers of the observation research [32], [33]. We observed and interviewed 56

pupils belonging to age groups from twelve to fifteen years studying in Espoo, Finland. We chose this target group because we felt that pupils have not established ways of searching information on the Internet.

We conducted observations during three days in April and May 2004 on the school's premises. There was always an observator present per pupil. All the observers had a Ph.D degree or were Ph.D students, and all of them had a full understanding of the research objectives and methods. The more specific description of our method is in our working papers of the observation research [32], [33].

Briefly, the observational study was conducted in the following way: The observer explained the purpose and objectives of the study to the pupils who were asked to follow the general principle of the observational research - to speak aloud, i.e. comment on all the moves and reasons for their choices while they were searching for information. Background information on the pupils was gathered a formal sheet and we used a standardized form to note the answers of the pupils. After each interview, the respective observer went through the results with the Ph.D. student who inserted the data in a database. As the person to insert data was the same all the time it was ensured that every single observation was understood in the same way.

4.2 Measures of search behavior

We used he same measures of search behaviour as Urbany et al. [48] based on Kiel & Layton´s study in 1981 [27]. The measures of actual shopping time, number of brands considered, and number of stores shopped in are nearly identical to the measures reflected in Kiel & Layton´s [27] retail search factors. The respondents were also measured (not just asked) the real number of different stores at which they shopped, the number of alternatives they considered, and the various sources of information they used. The width of search can be defined as the number of alternatives considered. The depth of search describes how many attributes of a product are evaluated.

We observed several elements of the search process: how the pupils started their search, which search strategies were employed, how the pupils proceeded, which products were chosen, at what price and in what time. Constructs of width and depth of search are measures of the extensiveness of search.

4.3 The design of the experiments

We designed three assignments to measure the effects of knowledge and choice uncertainty on the search effort. The assignments were a simple product search and comparison tasks during which the subjects were asked to think aloud their actions and the reasons behind them. The three assignments were worded as follows:

Assignment 1: Buy a Christmas present CD for Your grandmother.
Assignment 2: Buy the Red Hot Chili Peppers' "By the way"- CD for a friend.
Assignment 3: Buy a CD yourself.

In the first assignment, knowledge uncertainty was high while choice uncertainty was low. The subjects were unlikely to be familiar with the music categories searched for the CD, yet, choice uncertainty was low since the risks related to an adverse choice were low – the subject would not be stuck with the record. The second assignment was designed to have both low knowledge and choice uncertainty. The music category should be familiar to most subjects and the task was narrowly framed to lower choice uncertainty. In the third assignment, knowledge uncertainty was low because the subjects were knowledgeable about the music genres of their choice. Choice uncertainty, on the other hand, was high since they had the chance to win the record and, therefore, were at some pressure to make a good choice.

5. Results

5.1 Actual shopping time

High knowledge uncertainty affects the search effort, even though the actual effect is still undecided. It appears that in some settings high knowledge uncertainty promotes search while in other contexts high knowledge uncertainty inhibits search. We did not take a prior stand on the issue, but accepted that knowledge uncertainty has an effect on the extent of the search effort. We designed our experiment to include one assignment with high knowledge uncertainty (1st assignment) and two assignments (2nd and 3rd) low on knowledge uncertainty in an attempt to control the effect of choice uncertainty on search.

We propose to operationalize the effect of knowledge uncertainty as the time spent for search, since time captures the total effort of search better than most other measures. We formulated hypothesis 1, consumers spend more time on search under high knowledge uncertainty, as follows:

$$H_0 : \mu_1 = \mu_2 = \mu_3$$
$$H_1 : \mu_1 \neq \mu_2 = \mu_3$$

We scrutinized the data to ensure that the tested variables were normally distributed or did not depart too markedly from normality. For the paired samples t-tests, the α-risk was controlled at 0.05 when $\mu_1 = \mu_2 = \mu_3$.

The actual shopping time varied between 4.19 minutes to 6.3 minutes (see Table 1). On average, the pupils spent the most amount of time on the first assignment (6.3 minutes), and the least on the second assignment (4.2 minutes). The third assignment took them, on average, 4.5 minutes to complete. These figures suggest that knowledge uncertainty increases the amount of time spent on search, for knowledge uncertainty was high in the first assignment.

The t-tests suggest that the first assignment deviated markedly from the later assignments judged by the amount of time the subjects used to search. This supports the hypothesis (H_1) that high knowledge uncertainty leads to extended search. The difference in average times for the second and third assignments was too small to be statistically significant, which is congruent with the low knowledge uncertainty for the two assignments.

It is also noteworthy, that the standard deviation of the time spent on the assignments steadily decreased during the test. We interpret this as a sign of a learning effect. The subjects experienced decreasing knowledge uncertainty related to the electronic markets of music as even the least experienced gained knowledge about music retailers on the Internet.

Table 1: The effect of uncertainty on shopping time.

	Assignment		
	1	2	3
Avg.	6.339	4.188	4.464
Std.Dev.	3.589	3.423	2.593
N	56	56	56

T-tests		
Pairs	t-value	p-value (2-tailed)
1 & 2	4.583	0.000
1 & 3	3.815	0.000
2 & 3	-0.628	0.533

5.2 Size of the consideration set

The size of the consideration set, the number of different alternatives or brands considered during an assignment is another indicator of the extent of the search and as such should reflect the uncertainties experienced during the search. Choice uncertainty should primarily affect the amount of product detail information searched for rather than the size of the consideration set. In electronic markets, however, the service component adds a new dimension of differentiation to the products. Hence, consumers should be inclined to construct larger consideration sets to differentiate between the offerings when high choice uncertainty prevails.

We operationalized the effect of knowledge uncertainty as the number of records the subjects considered during search. We formulated hypothesis 2, consumers construct larger consideration sets under high knowledge uncertainty, as follows:

$$H_0 : \mu_1 = \mu_2 = \mu_3$$
$$H_1 : \mu_1 \neq \mu_2 = \mu_3$$

Table 2: The effect of uncertainty on the size of the consideration set.

	Assignment		
	1	2	3
Avg.	1.464	1.482	5.482
Std.Dev.	1.513	2.248	13.203
N	56	56	56

T-tests		
Pairs	t-value	p-value (2-tailed)
1 & 2	-0.051	0.960
1 & 3	-2.231	*0.030*
2 & 3	-2.241	*0.029*

The sizes of the consideration sets for the three assignments have been reported in Table 2. For the paired samples t-tests, the α-risk was controlled at 0.05 when $\mu_1 = \mu_2 = \mu_3$. The subjects considered few options in the first two assignments (1.5 products), yet, constructed markedly larger consideration sets for the last assignment (5.5. products). These differences were also statistically significant, as can be seen in Table 2. Our results suggest that consumers tend to construct larger consideration sets when faced with high choice uncertainty. The standard deviation

related to the size of the consideration set increased during the experiment and was at its highest in the third assignment. It is of interest that this happened simultaneously with the decreasing standard deviation in actual shopping time. We interpret this as a sign of interaction between increasing familiarity with the market and experience. The more experienced Internet users were better able to assimilate the market structure and, hence, they were able to improve their search performance more than the less experienced subjects.

5.3 Number of attributes consulted

Choice uncertainty (CU) should affect the size of the purchase decision, i.e. the number of product attributes taken into account. The logic behind this proposition is as follows. If none of the options in the consideration set dominate others, consumers tend to seek additional product attribute information that can be used to be able to rank the options. Decision-making theory suggests that if several options are equally good, there is little effort in choosing since the decision maker is equally well off no matter which one he decides to choose. A random choice is a rational action in such a situation. Consumer behavior research, however, posits that people seldom appear to resort to casting dice. Rather, they tend to have a need to make decisions on rational grounds, or at least to be able to rationalize the decision.

We aimed to explore the proper conceptualization of the choice uncertainty and test the effect of choice uncertainty on the search effort by comparing the number of product attributes our subjects considered during the three assignments. The assignments were constructed so that they varied in the amount of choice uncertainty. Choice uncertainty was high for the third assignment for the subjects had a chance of winning the selected CD and, therefore, the risk on adverse selection was real.

The number of product attributes considered during the product choice may reflect two things: 1) product complexity, and 2) choice uncertainty. In our study, product complexity was controlled by using products of the same category through all of the assignments. Hence, any differences in the number of attributes reviewed should reflect the effect of varying levels of choice uncertainty. The attributes that were measured in each assignment were: price, availability, list of records, music samples and other (artist) attributes. We operationalized the effect of choice uncertainty as the number of attributes the subjects brought to the decision. We formulated hypothesis 3, consumers employ a higher number of attributes under high choice uncertainty, as follows:

$$H_0 : \mu_1 = \mu_2 = \mu_3$$
$$H_1 : \mu_1 \neq \mu_2 = \mu_3$$

We ran paired sample t-tests to compare the number of product attributes the subjects looked for and present the results in Table 3. For the pared samples t-tests, the α-risk was controlled at 0.05 when $\mu_1 = \mu_2 = \mu_3$. The subjects employed markedly fewer attributes in the second assignment than in the other assignments reflecting behavior prescribed by the decision-making theories. In other words, the subjects didn't attempt to labour the decision past the point of having found the prospective offerings. We interpret this finding to suggest that consumers may not engage in a more extensive product attribute search, at least for low involvement products, when faced with little variation between the market offerings. Rather, they are willing to accept small shortcomings, in absolute terms, in their final choice. Extensive inspection of product attributes seems to associate with either high choice or knowledge uncertainty. Hence either choice or knowledge uncertainty seems to be a sufficient condition for employing a large attribute set in product choice.

Table 3: The effect of choice uncertainty on the number of product attributes considered.

	Assignment		
	1	2	3
Avg.	1.464	0.946	2.125
Std.Dev.	1.513	0.699	4.221
N	56	56	56
T-tests			
Pairs	t-value	p-value (2-tailed)	
1 & 2	2.602	*0.012*	
1 & 3	-1,152	0,254	
2 & 3	-2.068	*0.043*	

6. Conclusions

The study of consumer behaviour in electronic markets and consumer choice of distribution channels, is in need of sound theoretical frameworks that enable researchers to integrate electronic markets research with adjacent fields of study. Previous research has largely relied on concepts such as price, brand, and loyalty to explain consumer behaviour in electronic markets. While the insights have often

been valuable, they have been largely explorative and difficult to assimilate to existing consumer behavioural research for lack of a connecting theoretical frame. In this paper, we have demonstrated that uncertainty is a concept that can be used to explain the variation in the extent of consumer search in electronic markets. We have operationalized uncertainty with two constructs, knowledge uncertainty and choice uncertainty. Our analyses suggest that knowledge uncertainty affects shopping time while choice uncertainty affects the number of alternatives and the number of product attributes considered in the purchase decision.

Uncertainty has been established as the motive of consumer search (Stigler, 1961). It is a concept that can be used to link electronic markets research to economic, consumer behaviour, and decision-making research facilitating the creation of a fuller picture of the effects electronic markets may have on consumer behaviour.

The concept of uncertainty provides us with a coherent theoretical frame to explore consumer search in electronic markets. Previously the patterns and extent of consumer search have been explained by using concepts such as price, brand, and loyalty. While these concepts are valid, as such, they share little theoretical ground and it is not clear how they could be fitted into a framework encompassing the essential factors of consumer search. Uncertainty, on the other hand, is a concept well established as the foundation of consumer search. It is also the prime concept linking consumer search and decision-making theories. As decision-making is central to consumer search, it is hoped that uncertainty could be conceptualized further to create a theoretical frame that could be used to analyze any consumer search process in electronic markets.

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Relationship between Uncertainty and Patterns of Pre-purchase Consumer Search in Electronic Markets

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Abstract

Electronic markets are expected to facilitate consumer information search and product comparison to the extent that consumers are able to accumulate nearly perfect information. We present an analysis of search patterns based on a laboratory experiment on product search processes. We identified three types of search patterns in our experiment: sequential, simultaneous, and iterative. We found that search pattern has an impact on search costs and the efficiency of search judged by the purchase price. Sequential search emerged as the still dominant search pattern even though it leads to the most expensive purchase. Simultaneous search seems to combine low search costs with the highest efficiency. Iterative search pattern was the slowest. We also studied the relationship between uncertainty and search pattern, because uncertainty should have an effect on the search pattern employed. We found that uncertainty is strongly related to search behavior, but not to the search pattern employed.

1. Introduction

Consumer search is the main method, besides advertising, for acquiring information necessary to make purchase decisions. Consumers look for products with desired qualities and sellers offering these products at competitive prices in an attempt to decide what, when, and from whom to purchase. Markets are dynamic, which results in information becoming obsolete [33]. Changing identity of sellers and buyers, and also fluctuations in supply and demand, result in uncertainty. Identification of prospective products and sellers is often the dominant motive of search. Another, yet related, cause is consumers' inability to ascertain product quality and seller reliability before the purchase decision [39], [40].

Information search precedes many consumer decisions [26], [7], [28], [3], [30]. However, while extensive search may precede some procurement decisions, others are made routinely with little, if any, search and consumers are often found to engage in limited search even for high-ticket durables [25]. The complexity of consumer decision phenomenon is depicted by a notion that more than 60 determinants have been related to pre-purchase consumer search [30].

Information search is often costly [33]. The main cost factor is typically the opportunity cost of the searcher's time. Search costs depend on consumer's ability to search, which heavily impacts the pattern of search one can adopt. Search theory is rather uniform in its definition of the implications of search costs on consumer behavior and price dispersion. Stigler [33] proposed that high search costs will lead value maximizing consumers to limit their pre-purchase search, which results in less than perfectly informed purchase decisions. Since consumers vary on their market knowledge and search costs, relatively wide price dispersions persist in many consumer markets. The very basis of search theory [33] suggests two of the most profound measures of search costs: the amount of search and price dispersion for products of comparable quality. These are the two key measures that this work examines in an attempt to determine how electronic consumer markets have affected pre-purchase consumer search.

Consumer information search has been one of the most enduring literature streams in consumer research [3]. Marketing and consumer behavior researchers have been examining consumer's pre-purchase information seeking behavior since at least 1917 [10] and even today most consumer information processing and decision making models include pre-purchase information search as one of the key components [5], [7], [12], [14], [27]. There have been three major theoretical streams of consumer information search literature [30], [32]: psychological / motivational, economics, and consumer information processing approaches.

In recent decades, there have been many investigations into consumer search behaviour in a digital

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environment [8], [9], [15], [16], [17], [21], [30], [31], [40] in the context of search attributes [17], [30], [40]. Recently, there has been research into internet-based market efficiency [23], [40] and search costs [13], [15]. In a digital environment consumer information pre-purchase and search behavior is expected to be different from the traditional search behaviour [16], [17], [39].

The research of consumer behaviour in electronic markets and consumer choice of distribution channels is in need of sound theoretical frameworks that enable researchers to integrate electronic markets research with adjacent fields of study. Previous research has been largely explorative and difficult to assimilate to existing consumer behavioural research for lack of a connecting theoretical frame.

In this paper, we have demonstrated that search behaviour together with uncertainty is a concept that can be used to explain the variation in the extent of consumer search in electronic markets. In the body of this paper, we will first discuss the prototypical search patterns identified in consumer behavioral literature; sequential and simultaneous search. This work then connects the pattern of the search process to the outcomes of search, i.e. price of purchase and time cost of search. We set up a laboratory experiment in which the subjects searched for compact discs in contexts with varying degree of purchase related uncertainties. We have observed the resulting search process, identified the prototypical patterns of search, and studied the impact of the patterns on the outcomes of search. For consumer uncertainty we will propose a new conceptualization, based on the multiple criteria decision making lexicon. We will test the effect of uncertainties and search patterns by constructing a truth table to find the explanation with the least number of gaps to account for the different patterns of search. Finally we will discuss the outcomes of search.

We have three claims in our work: 1) Consumers employ different search patterns in their pre-purchase search. 2) Search is shaped by the uncertainties related to the purchase decision. 3) Search patterns have an effect on the outcomes of search.

2. Information search behaviour

There have been three major theoretical streams of consumer information search literature [30], [32]. The first is the psychological/motivational approach, which incorporates the individual, the product class, and the task related variables such as beliefs and attitudes [3], [11] and involvement [3]. The second is the economics approach, which uses the cost-benefit framework to study information search [30], [32]. The economic theory of search states that consumers weight the cost and benefits of search when making search decisions. The third one is the consumer information processing approach which focuses on memory and cognitive information processing theory [30], [32].

Search is often characterized by the locus of search activity. Information search behavior can be defined as "the motivated activation of knowledge stored in memory or acquisition of information from the environment" [12]. As the definition suggests, information search can be either internal or external. Internal search is based on the retrieval of knowledge from memory. On the other hand, external search consists of collecting information from the marketplace [12]. Generally, it is believed that consumers tend to acquire information as a strategy of certain risk reduction efforts in the events of identified uncertainty regarding the outcome of an action [24] and in the events of identified discrepancy between external information and prior product knowledge to protect themselves and to maximize their satisfaction [5], [35]. However, consumers' information search behavior is likely to be influenced by the perceived cost of information search. Consumers are likely to search for information as long as they believe that the benefits of acquiring information outweigh the cost of information search as indicated in "the economics of information" theory [33].

As a measure of search behavior we followed the example of Urbany et al. [35] based on Kiel & Layton [18]. Search behaviour can be measured by the actual shopping time (AST), and we used actual minutes spent on search, instead of Urbany et al. [31] who asked buyers to estimate the total time on shopping. In addition, we noted the price of the product.

Sub-constructs of search behaviour are the width and depth of search, meaning the extensiveness of search. The width of search can be defined as the number of alternatives considered. The depth of search describes how many attributes of a product or alternative are evaluated.

2.1 The costs of consumer information search

Cost of information search in the theoretical framework is presented by three dimensions: financial cost, time spent and cognitive effort required. Each dimension of cost represents a different perspective of cost. Financial cost represents the amount of money spent to acquire the necessary information. Time spent refers to the amount of time required for information search. Effort refers to the amount of cognitive effort required to process the information. The first dimension of the proposed cost of information search construct, financial cost, was first proposed by the Stigler [33] in the economics of information theory. The other two dimensions of the cost of information search, time spent, and effort required, are mostly utilized in consumer

behavior studies conducted mostly in laboratory conditions [6].

Search theory is rather uniform in its definition of the implications of search costs on consumer behavior and price dispersion. Stigler [33] proposed, that high search costs will lead value maximizing consumers to limit their pre-purchase search, which results in less than perfectly informed purchase decisions. Since consumers vary on their market knowledge and search costs, relatively wide price dispersions persist in many consumer markets. The very basis of search theory [33] suggests two of the most profound measures of search costs: the amount of search and price for products of comparable quality. These are the two key measures that this work examines in an attempt to determine whether electronic consumer markets have positively affected pre-purchase consumer search.

3. Search patterns

The economics literature is interested in exploring optimal search behaviour with the cost – benefit framework. Most studies see sequential search as the dominant way of searching. Kohn and Shavell [19] even define search as "sequential sampling from a population where the samples could be prices, product features etc." The Internet has, however, changed the hegemony of sequential search, since ways of searching, previously maybe possible, but difficult, are now made easier for consumers. In this section, different ways of searching, mainly in the online settings are examined.

In addition to the two prototypical search patterns, sequential and simultaneous searching, a third pattern, iterative search, emerged in our experiment.

3.1 Sequential searching

Sequential search is a process whereby a consumer wishing to buy one unit of commodity obtains quotations one-at-a–time until a satisfactory price is obtained. In an online environment, an example of a sequential search is a consumer surfing through different Web pages, and visiting various online-sellers [36], [38].

3.2 Simultaneous searching

According to Stigler [33], search takes place when a buyer (or seller) wishes to ascertain the most favorable price, and must thus canvass various sellers (or buyers). Stigler developed the "economics of information" EoI theory on the assumption of the so called *fixed sample size (FSS) searching*, according to which an individual obtains all samples at once, and the commodity is purchased from the seller quoting the lowest price. In other than the economics literature, FSS searching is also called *simultaneous* searching. The essence of simultaneous searching is that a consumer is able to evaluate available products side by side.

In offline circumstances, a consumer might collect a simultaneous sample based on either internal information formed by experience of repeated purchases (internal search), or by, for example, acquainting her/himself with special issues of consumer journals that compare products the consumer is interested in (external search). In online settings, a consumer can use various tools (for example, comparison sites or comparison agents) to collect information that is available on the Internet on a particular product or service. According to Whinston et al. [36], price search in a price database is an example of a simultaneous search in an online environment.

Electronic and simultaneous search is given a definition by Öörni [39], [40] the characteristics of which are i) the information channel is electronic, ii) all the information is retrieved in a single stage iii) no human interaction is required. In his empirical research Öörni [39], [40] found out that the use of electronic and simultaneous search in the context of travel services was very rare in the beginning of 2000's.

Manning and Morgan [22] stated that both simultaneous search and sequential search may be considered special cases of a *general search pattern*, according to which a searcher obtains more than one sample at a time and then has to decide how many more times to sample. Agrawal et al. [1] compared simultaneous and sequential search, and concluded that simultaneous search allows for information gathering quickly, though overinvestment in information gathering may occur (i.e. the simultaneous sample might be too extensive). Sequential search, on the other hand, is slow, but avoids unnecessary information gathering. The optimal search pattern has been suggested to combine the speed of simultaneous search with the flexibility of sequential search to avoid unnecessary costs [1].

3.3 Iterative searching

The possibility to return to price / product information that was previously searched but not chosen can be called *iterative search.* Iterative search allows back-and-forth-movement as consumers compare product and service offerings. An iterative search begins just as a sequential query to the product information. The definition of iterative search might be sequential search with recall The query results are compared to each other, and then results are noted. The difference to sequential search is that after finding the outputs, consumer will make the query again, and the process is then repeated.

4. Uncertainty and search behavior

One reason consumers search for information prior to purchase is to reduce uncertainty. Information search is often seen as a mean to lessen decision-related uncertainty. Therefore, greater uncertainty should lead to more extensive search behaviour [20]. Some early studies of uncertainty constructs and uncertainty dimensions of "knowledge uncertainty" and "choice uncertainty" have been done in the sixties and seventies [4], [33], [20], [37], [5]. However, many researchers have argued that there may be certain conditions, under which uncertainty reduces, (instead of increases), search behavior [2], [37], [5].

Urbany et al. [35] have investigated information search in the context of consumer decisions. They identified various forms of decision-related uncertainty, which are likely to influence the information search in many ways. Consumer researchers have defined uncertainty in many different ways, for example, as perceived risk. Urbany et al. [35] defined uncertainty as *the amount of information the buyer brings to the search process.* If a consumer receives more information before shopping, s/he will have stronger prior beliefs and less uncertainty about which store to shop in. This definition is consistent with more traditional conceptualizations of uncertainty [34]. The dimensions of uncertainty, proposed by Urbany et al. [35] provide the central ingredients for our study. We will next define the two uncertainty dimensions found in the previous literature.

4.1 Knowledge uncertainty

Knowledge uncertainty (KU) captures doubts consumers have about their own ability to judge sellers and products well enough to execute rational product comparisons. Urbany [34] has defined KU as uncertainty about the knowledge of the alternatives and variables, i.e. what is known about alternatives. The original construct of knowledge uncertainty is from Stigler [33]. KU may arise from the lack of factual information about alternative choices and / or uncertainty over what decision rules are relevant [35]. KU may also be related to uncertainty over how to acquire the necessary information to make a choice. Several researchers [35], [5], [33] agree that the lack of (or uncertainty about) product knowledge increases search costs and therefore may reduce search.

High KU is associated potentially with reduced ability to comprehend and efficiently use new information, which makes information search a more difficult process. The link between prior knowledge or expertise, search cost, and search intensity has several proponents [2], [8], [28]. Experts with lower KU and greater prior knowledge about a product have a greater capacity for learning new information and therefore are more likely to search than non-experts [2]. Consumers might be certain about what model or brand to choose, and at the same time they might be very uncertain about the knowledge they hold about a given product class. In fact, consumers with low knowledge about the product category might experience a more difficult search task than consumers with a high prior knowledge of the product class. Those consumers higher in KU might search less than those with lower KU. In sum, if high knowledge uncertainty causes limited search, the result of that will be both high search costs and a difficulty of assessing the benefits of the search [35].

4.2 Choice uncertainty

Choice uncertainty (CU) means uncertainty about which alternative to choose [34], [35]. The original construct of choice uncertainty is from Lanzetta [20]. It is interesting how the characteristics in a choice set i.e., experienced similarities or differences between the current choices, contribute to CU. Information search will be greater when the choice sets are similar, because of the CU generated [20] In conclusion, Lanzetta argues that a bigger uncertainty, and on the other hand, a similar choice alternative set, should result in more executive search [20]. In contrast, Stigler´s EoI theory and cost - benefit model predicts [33] that a greater similarity between choice alternatives / choice-set will reduce search, due to lower expected gains from search and presumably lower choice uncertainty.

Sieber & Lanzetta [29] predict that consumers with less complex conceptual structures might be more likely to apply well-defined rules to make decisions. They predict that low CU may result from poor knowledge of the available choice-set (i.e., poor knowledge of what alternatives are available). According to Sieber & Lanzetta [29], consumers who utilize simple conceptual structures perceive less information and, therefore, they might experience less choice uncertainty than consumers who utilize complex structures [29].

CU is more influential than KU. Choice uncertainty might come from different sources, firstly, a high level of ignorance about the product or the market place or secondly, a relatively well-informed base of knowledge that suggests that there may be yet undiscovered alternatives [35]. Urbany et al. [35] defined choice uncertainty as uncertainty regarding which alternative to choose. According to them [35], choice uncertainty covers questions such as what and where to buy, and exists as a separate construct in the consumers' mind. They have further proposed that uncertainty related to the selection of the evaluative means may in fact be a separate entity. In their study, they found that choice uncertainty increases search behavior.

4.3 Impact of uncertainty on search behaviour

Urbany et al.[35] found that CU increases search behavior while KU reduces search. They found a strong relationship between CU and KU, and according to them, consumers can be high in KU yet low in CU and vice versa [35].. Therefore, it is possible that high KU may not always lead to high CU and greater search, even though CU and KU are positively related [35].. High KU is associated potentially with a reduced ability to efficiently use new information, which makes information search a more difficult process. The lack of (or uncertainty about) product knowledge increases search costs and therefore may reduce search [35].

According to Urbany et al. [35], three interesting results emerged in their study; Firstly, KU and CU are very strongly related. Secondly, the simple correlations indicate that both CU and KU are positively related to search behavior, although the correlations for KU are smaller. Thirdly, the regression and discriminant analysis results indicate that KU and CU both have significant effects on search, but the CU X KU interaction does not [35].

In the light of these findings, it becomes apparent that it might be useful to study the relationship between uncertainty measures and consumer pre-purchase search, and buying behavior.

5. Method

The effect of individual differences and purchase situations on search behavior is complex, often interactive and difficult to interpret and generalize about [35]. Therefore, we chose as cohesive a group as possible for our observation research. Our response group consisted of 12-15 year old teenagers from the same demographic area. Our observation situation was the same for every respondent, interactive purchase via Internet without time limits.

The method used in this study is empirical observation. We chose this method in order to find out what people really do in a search and purchase situation, instead of just asking what they think they would do. The more specific description of our method is in our working papers and former paper of the observation research [21]. We observed and interviewed 56 pupils belonging to age groups from twelve to fifteen years studying in Espoo, Finland. We chose this target group because we felt that pupils have not established ways of searching information on the Internet. We conducted observations during three days in April and May 2004 on the school's premises. There was always one observer present per pupil. All the observers were experienced researchers briefed of the research objectives and methods prior to the experiments.

The observational study was conducted in the following way: The observer explained the objectives of the experimental tasks to the pupils who were instructed-to think aloud, i.e. comment on all their moves and reasons for the choices while they were searching for information. Background information on the subjects was gathered with a formal sheet and we used a standardized form to record the actions of the subjects. After each interview, the respective observer went through the results with the one researcher who was responsible for inserting the data in a database. Having one person to insert data was meant to ensure consistent interpretation for all observations.

5.1 The design of the experiments

We designed three assignments to measure the effects of knowledge and choice uncertainty on the search effort. The assignments were simple product search and comparison tasks during which the subjects were asked to think aloud their actions and the reasons behind them. The three assignments were worded as follows:

Assignment 1: Buy a Christmas present CD for Your grandmother.

Assignment 2: Buy the Red Hot Chili Peppers' "By the way"- CD for a friend.

Assignment 3: Buy a CD yourself.

In the first assignment, knowledge uncertainty was high while choice uncertainty was low. The subjects were unlikely to be familiar with the music categories searched for the CD, yet, choice uncertainty was low since the risks related to an adverse choice were low – the subject would not be stuck with the record. The second assignment was designed to have both low knowledge and choice uncertainty. The music category should be familiar to most subjects and the task was narrowly framed to lower choice uncertainty. In the third assignment, knowledge uncertainty was low because the subjects were knowledgeable about the music genres of their choice. Choice uncertainty, on the other hand, was high since they had the chance to win the record and, therefore, were at some pressure to make a good choice.

6. Results

6.1 Identification of search patterns

Three different search patterns were identified during the experiment thus confirming our first proposition on different search patterns that consumers employ in their pre-purchase search. Out of 168 units of analysis sequential search was employed 110 times (65%), simultaneous 37 times (22%), and iterative search pattern 21 times (13%).

6.2 Uncertainty as a determinant of search pattern employed

According to Urbany et al. [35] KU and CU both have significant effects on search. According to our second proposition, search is shaped by the uncertainties related to the purchase decision. According to this proposition, KU and CU embedded in the tasks should have an effect on the search pattern employed. According to the results, various levels of uncertainties do not seem to have any impact on the pattern of search employed since the sequential search pattern is the most usual search pattern in all tasks, as depicted in Table 3.

Table 1. Number of search patterns used in different uncertainty tasks

	Uncertainty		
	Task 1 *High KU*	***Task 2*** *Low Uncertainty*	***Task 3*** *High CU*
Simultaneous	13	13	11
Sequential	33	38	39
Iterative	10	5	6

6.3 The effect of uncertainty on outcomes of search

High knowledge uncertainty affects the search effort. It appears that in some settings high KU promotes search while in other contexts high KU inhibits search. We did not take a prior stand on the issue, but accepted that KU has an effect on the extent of the search effort. We designed our experiment to include one assignment with high knowledge uncertainty (1st assignment) and two assignments (2nd and 3rd) low on knowledge uncertainty in an attempt to control the effect of choice uncertainty on search.

We propose to operationalize the effect of KU as the time spent for search, since time captures the total effort of search better than most other measures. We claim that search is shaped by the uncertainties related to the purchase decision, and formulated more specifically as follows: Consumers spend more time on search under high knowledge uncertainty, as follows:

$$H_0 : \mu_1 = \mu_2 = \mu_3$$
$$H_1 : \mu_1 \neq \mu_2 = \mu_3$$

We scrutinized the data to ensure that the tested variables were normally distributed or did not depart too markedly from normality. For the paired samples t-tests, the α-risk was controlled at 0.05 when $\mu_1 = \mu_2 = \mu_3$.

Table 2: The effect of uncertainty on shopping time.

Time	**Uncertainty**		
	Task 1 *High KU*	***Task 2*** *Low Uncertainty*	***Task 3*** *High CU*
Avg.	6.339	4.188	4.464
Std.Dev.	3.589	3.423	2.593
N	56	56	56

T-tests		
Pairs	t-value	p-value (2-tailed)
1 & 2	4.583	0.000
1 & 3	3.815	0.000
2 & 3	-0.628	0.533

The actual *shopping time* varied between 4.19 minutes to 6.3 minutes. On average, the pupils spent the most amount of time on the first assignment (6.3 minutes), and the least on the second assignment (4.2 minutes). The third assignment took them, on average, 4.5 minutes to complete.

These figures suggest that KU increases the amount of time spent on search, for KU was high in the first assignment. The t-tests suggest that the first assignment deviated markedly from the later assignments judged by the amount of time the subjects used to search. This supports the hypothesis (H_1) that high knowledge uncertainty leads to extended search. The difference in average times for the second and third assignments was too small to be statistically significant, which is congruent with the low KU for the two assignments.

It is also noteworthy, that the standard deviation of the time spent on the assignments steadily decreased during the test. We interpret this as a sign of a learning effect.

Table 3: The effect of uncertainty on purchase price.

Price	Uncertainty		
	Task 1 High KU	*Task 2* Low Uncertainty	*Task 3* High CU
Avg.	15.64	15.68	13.66
Std.Dev.	5.106	15.363	5.604
N	56	56	56
T-tests			
Pairs	t-value	p-value (2-tailed)	
1 & 2	-0.04	0.9651	
1 & 3	1.96	0.0530	
2 & 3	1.95	0.0533	

6.4 The effect of search patterns on outcomes of search

Our third proposition suggests that search patterns have an effect on the outcomes of search. We propose to operationalize the effect of search pattern as the time spent for search, since time captures the total effort of search better than most other measures.

We formulated hypothesis 3 so that both search time and the price at which consumers were able to find a suitable product are dependent on the search pattern. Our null hypothesis is that observed shopping time and best prices found were equal over the tasks, i.e. the amount of uncertainties did not affect either.

H0 = $\mu_1 = \mu_2 = \mu_3$.
H1 = $\mu 1 \neq \mu 2 \neq \mu 3$

Table 4. The effect of search pattern on shopping time.

Time	Search Pattern		
	Simul-taneous	**Sequen-tial**	**Iterative**
Avg.	4.49	4.76	7.19
Std.Dev.	2.59	3.41	3.52
N	168	168	168
T-tests			
Pairs	t-value	p-value (2-tailed)	
Sim & Seg	-0.50	0.6180	
Sim & Iter	-3.08	0.0042	
Seg & Iter	-2.92	0.0068	

The actual *shopping time* varied between 4.49 minutes to 7.19 minutes (see table 5). On average, the subjects spent the most amount of time when using iterative search strategy (7.19), and the least when searching simultaneous (4.49 minutes). The difference in time used was statistically significant for iterative search when contrasted to simultaneous or sequential search. Thus, we conclude that iterative search is the most costly strategy while sequential and simultaneous search do not necessarily diverge in this respect

Table 5. The effect of search pattern on purchase price.

	Simul-taneous	**Sequen-tial**	**Iterative**
Avg.	11.70	16.20	14.00
Std.Dev.	5.46	4.93	5.18
N	168	168	168
T-tests			
Pairs	t-value	p-value (2-tailed)	
Sim & Seg	-4.67	<.0001	
Sim & Iter	-1.89	0.0662	
Seg & Iter	1.79	0.0837	

The actual purchase price in different search patterns varied from 11.70 euros to 16.20 euros. The pupils spent the most money when searching with a sequential pattern (16.20 euros), and the least when searching simultaneous. The difference in purchase price was statistically significant for simultaneous search against sequential search strategy. The difference between iterative search against the simultaneous and sequential strategies was statistically non-significant.

Judging by the result of our t-tests, the students spent the least amount of money when using simultaneous search strategy, both sequential and iterative strategies leading to more expensive purchases.

6.5 Search performance by uncertainty and search pattern

We examined next the combined effect of uncertainty and search pattern on the outcomes of search.

Table 6. Search performance time by uncertainty and search pattern

Time	Uncertainty		
Search pattern	***Task 1*** *High KU*	***Task 2*** *Low Uncertainty*	***Task 3*** *High CU*
Simultaneous	***5.54***	***3.54***	***4.36***
Sequential	5.97	4.14	4.41
Iterative	*8.60*	*7.00*	*5.00*

We found that iterative search pattern is the slowest under any uncertainty, whereas the differences in time spent on search between simultaneous and sequential patterns are not substantial. However, simultaneous search is somewhat more efficient than sequential search. Next, the combined effect of uncertainty and search pattern on price of the purchased product is examined.

Table 7: Search performance price by uncertainty and search pattern

Average price	Uncertainty		
Search pattern	***Task 1*** *High KU*	***Task 2*** *Low Uncertainty*	***Task 3*** *High CU*
Simultaneous	***14.62***	***11.00***	***9.09***
Sequential	*15.64*	*17.40*	*15.21*
Iterative	15.40	14.00	11.50

The sequential search pattern seems to lead to the most expensive purchase under any uncertainty. It is surprising that this search pattern is so common (employed 65% in our experiment) even though it results in the most expensive purchase.. Simultaneous search, on the other hand, leads to most inexpensive purchase but it was used only 22 % in the experiment. The effect of search pattern was independent of the related uncertainties, suggesting that the possible effects of uncertainty on the outcome of search are relatively small compared to the effects of the search pattern employed.

Our observation may explain, at least in part, why electronic markets have not increased market efficiency as much as expected, i.e. narrow price dispersion and low average prices. While the benefits of simultaneous search strategy seem quite apparent, the majority of the subjects did not exploit them. Consumers must adjust their behavior to the new environment to realize the potential benefits.

7. Discussion and Conclusion

In this paper, we have demonstrated that search pattern employed and search related uncertainties are concepts that can be used to explain the variation in the efficiency of consumer search in electronic markets.

Uncertainty has been established as the motive of consumer search [33]. That is a concept that can be used to link electronic markets research to economic, consumer behaviour, and decision-making research facilitating the creation of a fuller picture of the effects electronic markets may have on consumer behaviour. The concept of uncertainty provides us with a coherent theoretical frame to explore consumer search in electronic markets.

Previously the patterns and extent of consumer search have been explained by using concepts such as price, brand, and loyalty. While these concepts are valid, as such, they share little theoretical ground and it is not clear how they could be fitted into a framework encompassing the essential factors of consumer search. In addition to the two prototypical search patterns, sequential and simultaneous searching, we used iterative searching pattern in our study. The sequential searching is still the predominant way of searching, even among the youngsters.

Uncertainty, on the other hand, is a concept well established as the foundation of consumer search. It is also the prime concept linking consumer search and decision-making theories. As decision-making is central to consumer search, it is hoped that uncertainty could be conceptualized further to create a theoretical frame that could be used to analyze different decision making stages in consumer purchasing behavior in electronic markets. We have operationalized uncertainty with two constructs, knowledge uncertainty and choice uncertainty. In the following, we summarize the results of our experiment.

Uncertainty as a determinant of search pattern employed: According to our data, most people used sequential search pattern (65%). Theoretically, knowledge and choice uncertainty should have an effect on the search pattern employed, but as noted in results, the search patterns used by the pupils seem not to be dependant on the uncertainties of the tasks. It is possible that even the relatively young consumers have pre-existing, well developed search patterns, and they are reluctant to adjust their behavior to the new environment to realize the potential benefits. We found that even relatively young people tend to adhere to sequential search rather than simultaneous search pattern.

The effect of search patterns on outcomes of search: Our t-test shows that the actual shopping time varied between 4.49 minutes to 7.19 minutes according to the different search patterns. The actual purchase price according to the different search patterns varied from 11.70 euros to 16.20 euros.
Our observations seem to support the hypothesis (*H3*) that selection of search pattern has an impact on the efficiency of search judged by the amount of time the subjects used to search.

Uncertainty and search pattern as determinants of search performance measured by time: Our results suggest that knowledge uncertainty increases the amount of time spent on search. As the effects of uncertainty on search patterns are examined in more detail, the following results emerged: Iterative search is the most costly search pattern while sequential and simultaneous search do not necessarily diverge in this respect. When search patterns are taken into account, simultaneous search seems to be the most efficient search pattern when measured by time spent on search.

Uncertainty and search pattern as determinants of search performance measured by purchase price: Simultaneous search seems to be the most efficient strategy when measured by or purchase price. It would seem a prudent choice as simultaneous search is the least costly, judged by the time spent, and tends to lead to inexpensive purchases. The effect of the pattern employed was also independent on the related uncertainties, suggesting that the possible effects of uncertainty on the outcome of search are relatively small compared to the effects of the search pattern employed.

Simultaneous search seems to combine low search costs with high efficiency. The fact that it wasn't the strategy of choice for most of our subjects raises the question of the necessary preconditions to simultaneous search. It is possible that electronic markets are less transparent when it comes to search related meta-information: where to find a suitable search engine and how to use it. This knowledge must, for the large part, be extracted at a cost through on-going search.

8. References

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Uncertainty in Consumer Decisions

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Uncertainty has been identified as a major force shaping behaviour. The ubiquity of uncertainty in everyday choices is reflected in its prevalence in economic theories. Despite the acknowledged importance of uncertainty, however, the actual content of the concept is far from clear, for uncertainty has rarely been the focus of research. Presence of uncertainty has been used as a justification for the relevance of the study, rather than the object of the study in and of itself.

In this paper, we have studied the presence of uncertainty in consumer decisions. Uncertainty has clearly a multidimensional nature and its dimensions have various effects on consumer behavior. To identify the central dimensions of uncertainty, we have adopted the idea from Herbert Simon who proposed a generalized approach to model a decision making as a process (Simon 1960). We propose that uncertainty has four dimensions in consumer decision context: *knowledge uncertainty, evaluation uncertainty, choice uncertainty, and implementation uncertainty*. Those dimensions can be clearly identified from our empirical data by using exploratory factor analysis. The questionnaire used in our empirical study can be used to measure uncertainty on each dimension. Against previous wisdom, evaluation and implementation uncertainties seem to exercise stronger impact on consumer decisions than the other varieties of uncertainty in electronic commerce context.

Introduction

Consumption involves decision making with what to buy, where to buy, and when to buy being the most obvious choices to be made. Often consumers face these decisions without being fully informed about the many aspects of the purchase. Indecision may exist over the best choice alternative. The needs and wants, the evaluation criteria, are often less than clear or they can't be directly matched with the characteristics of the available choice alternatives. The limits of one's knowledge about the products may be in doubt. In addition, one's ability to see the purchase through, to implement the purchase decision, is often indeterminate.

Gaps in one's knowledge lead to feelings of insecurity, a mental state that is often termed uncertainty. Alba and Hutchinson (2000) note that "the correspondence between self-assessed and actual validity of knowledge is an important issue for the study of consumer decision making for high levels of correspondence are achieved rarely and moderate levels that include some degree of systematic bias

are the norm". Understanding the sources of uncertainty related to consumer decisions is a key to better serve the customer. Relevance of uncertainty in the context of electronic retailing has been demonstrated by e.g. Brynjoflsson and Smith (2000), who observed uncertainty reflected in customers' willingness to frequent sellers they had personal experience with (loyalty effect) and, in lieu of experience, to patronize well-known sellers (brand effect). As a research topic uncertainty is gaining on importance, for electronic retailing relies on human-to-computer interaction, which offers little on-the-spot adaptation to varying consumer needs. Flexibility has to be built in the systems and, therefore, the sources of uncertainty will have to be identified well before systems are implemented.

Uncertainty features in research traditions of individual decision making, ranging from decision science to economics and marketing. In the general decision making literature, from early on, uncertainty has been identified as the necessary precondition of choice (Dewey 1910, p. 112). In decision making context, uncertainty has often taken the form of subjective probability (see e.g., Einhorn and Hogarth 1981), which suggests that uncertainty could be quantified. Einhorn and Hogarth (1986), for example, have offered that uncertainty (ambiguity in their parlance) operates on individual judgment through personal adjustments to initial estimates of probabilities. One of the more prominent roles for uncertainty has been awarded in consumer search literature. It has been identified as the ultimate cause for search, for "the changing identity of sellers and buyers and also fluctuations in supply and demand result in uncertainty, since information becomes obsolete" (Stigler 1961). Since then, uncertainty has been part of the canon of consumer search literature. Yet, its composition has remained vague. Some efforts have been made to resolve the inner structure of uncertainty. Urbany et al. (1989) suggested that at least two dimensions of pre-purchase uncertainty exist and have quite opposite effects on consumer search behaviour. However, the authors themselves noted that their analyses suggested the existence of further dimensions in the uncertainty concept, which their data did not fully account for. Few efforts have been made to remodel pre-purchase uncertainty since. We are in need of identifying the causes of uncertainty and connecting them to their effects on consumer behaviour. As a foundation of consumer behaviour, the composition of consumer decision related uncertainty needs to be defined in a theoretically coherent frame of reference.

In this paper, we aim to model the structure of consumer decisions related uncertainty from the decision making perspective. We apply a theoretically coherent framework, the decision process model originally proposed by Herbert Simon (1957, p. 67) to identify the salient dimensions of uncertainty and to test for their relevance in consumer pre-purchase behaviour. Our tests suggest that four dimensions: *knowledge uncertainty, evaluation uncertainty, choice uncertainty, and implementation uncertainty* are major determinants of total uncertainty related to consumers' pre-purchase decision process. Our analyses further demonstrate that, opposite to earlier findings, evaluation uncertainty and implementation uncertainty may be the strains of uncertainties that affect consumer pre-purchase behaviour in electronic markets the most.

The paper is organized in five sections. In the next section, we provide an overview on the role of uncertainty in consumers' decision making literature and develop our approach. The survey is described in section 3 and results are given in section 4. We conclude the paper in section 5.

Theory

To chart the contents of the uncertainty concept in relation to consumer decisions, we will address three interrelated topics. We will start by reviewing previous conceptualizations of consumer uncertainty and the identified uncertainty dimensions. We will next complement these dimensions by reviewing consumer behaviour literature on surrogates of uncertainty: consumer knowledge, experience, familiarity, and confidence. Lastly, we will discuss the competing decision making models for a theoretical framework to be used to define a coherent conceptualization of the uncertainty concept.

Dimensions of Uncertainty and Pre-Purchase Search

Stigler, in his seminal paper on economics of information, established that uncertainty is the driving force behind consumer search. Changing identity of sellers and buyers, and fluctuation in supply and demand result in uncertainty since information becomes obsolete (Stigler 1961). Consumers must therefore update their information, and there is often no better means to do that than search. Stigler's information search model builds on the premise that consumers have prior distribution for prices, yet they can't accurately predict any seller's price before getting a quotation (see e.g. Urbany 1986). While Stigler compressed product differences into a single dimension, price, he acknowledged that quality differences prevail in most consumer markets. Incorporating quality differences would have complicated the mathematical formulation of the problem, yet, did not affect the point Stigler made. In line with Stigler, Lanzetta (1963) posited that higher levels of uncertainty should lead to more extensive search (Lanzetta and Driscoll 1968). This position has received considerable empirical support: several constructs indicative of uncertainty (e.g. low prior knowledge, familiarity, experience) have been found positively associated with search (for an extensive review, see e.g. Fiske, Luebbehusen et al. 1994). This support has later proved equivocal, though. The relationship between uncertainty and search appears more intricate than originally hypothesized: negative, positive, and u-shaped relationships between surrogates of uncertainty and the search effort have been observed (*Ibid.*), and the conceptualization of uncertainty has been adapted accordingly.

Urbany et al. (1989) suggested that uncertainty is a multidimensional construct, and its effect on consumer search may be conditional to the dominant form of uncertainty present in the purchase decision. The authors distinguished two types of uncertainty, labelled knowledge uncertainty (KU) and choice uncertainty (CU). Knowledge uncertainty captures doubts consumers have about their own ability to judge sellers and products well enough to execute reasonable product comparisons, whereas choice uncertainty arises from the conflict about which alternative to choose (Urbany 1986; Urbany, Dickson et al. 1989). While the former construct is likened to the original idea of uncertainty put forth by Stigler (1961), the latter is reminiscent of "response uncertainty" coined by Lanzetta (1963), who, referring to Berlyne (1960), stated that uncertainty occurs when the "choice of the best alternative is equivocal" in the context of resolving a conflict. Later, Moorthy et al. (1997) examined uncertainty as a central factor of consumers' problem framing and suggested that some degree of both knowledge and choice uncertainty are necessary antecedents of search as "in the common situation in which the consumer has brand-specific prior distributions, whether the consumer searches at all depends not only on involvement, search cost, and individual brand

uncertainty but also on whether there is relative brand uncertainty." In their terminology individual brand uncertainty is close to knowledge uncertainty and relative brand uncertainty close to choice uncertainty.

Urbany et al. (1989) found knowledge and choice uncertainties having opposite effects on consumer search. While choice uncertainty increased the amount of search, knowledge uncertainty had a weaker negative effect. The finding that uncertainty may both induce and limit search is in conflict with the position the economics of information theory has taken on uncertainty, according to which higher levels of uncertainty signifies greater benefits of receiving new information and, thus, more extensive search (see e.g. Stigler 1961). The source of this seeming discrepancy lies, we believe, in the formulation of knowledge uncertainty concept used by Urbany et al. (1989). The original authors acknowledged that their uncertainty constructs were highly correlated, which they interpreted suggesting the presence of yet another dimension of uncertainty, labelled evaluation uncertainty. Theoretical support for such a proposition can be found in decision making literature in which uncertainty has been tagged as an antecedent of judgment (Dewey 1910, p. 9, 102).

It is well established in the decision making literature that judgment and choice may not be psychologically equivalent for choice implies greater commitment (Janis and Mann 1977; Beach and Mitchell 1978). This inequality is also reflected in common language as one can make a choice against one's better judgment (Einhorn and Hogarth 1981). Johnson and Russo (1984) suggest that incompatibility of judgment and choice may account for the observations of consumer choice processes being phased and combining decision strategies, such as elimination by aspects and additive utility, to make a choice. It appears that choice is characterized by elimination and "one-sided" search, while judgment implies more evaluation and a more balanced pattern of search (Johnson and Meyer 1984). Another practical expression of this disconnection is the regular failure of formal decision making models to reconstruct choice from its component judgements (i.e. evaluations) (Einhorn and Hogarth 1981). Hence, we feel that the choice uncertainty construct should be allotted to account for choice related doubts while evaluation uncertainty should be redefined to cover one's doubts over knowledge related judgements, which we will address shortly. Both of these uncertainties operate on the level of general purchase related knowledge rather than on brand related knowledge.

Punj and Staelin (1983, p. 368) distinguished between organization of product information and actual product attributes. They included in the concept of Prior Memory Structure "the consumer's knowledge of the buying process as well as knowledge associated with [the product category] in general". The concept has since been adopted under the labels of Product Class Knowledge (Brucks 1985) and Product Category Knowledge (PCK) (Fiske, Luebbehusen et al. 1994). Studies focusing on PCK have usually identified positive association between knowledge and the magnitude of search effort (Brucks 1985). Usable Prior Knowledge (Punj and Staelin 1983, p. 368), on the other hand, refers to the actual, detailed information accumulated. The concept has since received multiple labels, yet, the one that seems to enjoy the most widespread acceptance is Brand Knowledge (BK) (e.g. Brucks 1985; Fiske, Luebbehusen et al. 1994). Brand knowledge has often been found to limit search through a de-motivating effect: The more consumers have accumulated detailed product information, the less benefit they perceive in search.

Brand knowledge and product category knowledge show signs of being related as they tend to develop in tandem (Fiske, Luebbehusen et al. 1994). They do not, however,

seem to share all of their antecedents: "Specific product-class information is gained by using the product in everyday activities, while directly relevant purchase-task information is obtained each time a person goes through the task of buying … ." (Punj and Staelin 1983) Hence, the two types of knowledge are usually seen conceptually distinct, the PCK capturing the evaluative dimension of purchase decision and BK the actual product details. This distinction can also be found in Urbany's (1986) characterization of abstract (i.e. product category related) and concrete product related knowledge. Fiske et al. (1994) suggest two reasons to distinguish between BK and PCK. "First, the two constructs may have different effects on search behaviour. Second, while BK and PCK likely develop in tandem over time, there are many situations in which existing PCK is relevant to a search problem, yet BK is not (e.g., when a consumer moves to a new market or several new brands have been introduced since the last purchase)." We feel that the conceptual division of knowledge should be reflected in the conceptualization of uncertainty as well. The definition of the knowledge uncertainty construct put forth by Urbany et al. (1989) suggests that KU captures the evaluation dimension of the purchase decision, while CU covers the doubts over which alternative to choose. Also, Fiske et al. (1994) related the knowledge uncertainty measures employed by Urbany et al. (1989) to product category knowledge. It appears that we are lacking an uncertainty dimension which covers the doubts related to detailed product information, brand knowledge. Further, the third dimension of uncertainty that Urbany et al. (Ibid.) proposed, evaluation uncertainty, seems to overlap the current KU dimension, which they defined in terms of evaluative doubts.

To resolve the conceptual dilemma with uncertainty, we propose that the original knowledge uncertainty dimension should be relabelled as evaluation uncertainty since its substance is really more related to ability to evaluate products rather than doubts over detailed product knowledge. The label of knowledge uncertainty, then again, should be redefined to cover doubts over brand knowledge, as the name suggests. As to the observed correlations between uncertainty constructs (Urbany, Dickson et al. 1989), we refer to the previous discussion about knowledge categories having common antecedents. Closer to the uncertainty concept, subjective evaluations on one's purchase related knowledge are found to be more based on product related experiences than on the more abstract product category related knowledge (Park, Mothersbaugh et al. 1994). This connectedness is also noted in decision making literature, which points to judgment and choice being related even if one often can't reconstruct choice from its component judgments. Therefore, it is only logical to expect that knowledge uncertainty is somewhat correlated with evaluation and choice uncertainties, while the dimensions are conceptually distinct. Hence, we take it that evaluation uncertainty and choice uncertainty share some of their antecedents and that the correlations observed by Urbany et al. (1989) reflect this.

To complete our search for candidate dimensions for consumer decisions related uncertainty, we next consider the possibility of uncertainties related to implementation of the purchase decision affecting pre-decision considerations (see Table 1 for a summary of supporting literature). It is possible that uncertainties related to the later stages of the purchase process are projected to the decision. This notion is already embraced by the original definition of product category knowledge (Punj and Staelin 1983) according to which the prior memory structure captures "the *consumer's knowledge of the buying process* as well as the knowledge associated with [the product category] in general". Such nonfunctional motives of shopping as *company responsiveness* and *reputation* have been con-

nected to retail channel selection (Eastlick and Feinberg 1999) suggesting that implementation of the purchase decisions is of concern to consumers. Closer to electronic markets environment Brynjolfsson and Smith (2000) found *trust* an important source of perceived heterogeneity in Internet retailers. In general, trust, is found an antecedent of consumer loyalty, the propensity of consumers to switch their purchase allegiances. Finally, an entirely different vein of literature, namely cognitive psychology, also points to implementation being conceptually separate from evaluation and choice phases of action. Ajzen (2002) suggests that positive attitude towards action, and the related intention to act, may not consistently predict future behavior unless they are complemented with an implementation plan, an implementation intention in Ajzen's parlance. Planning to implement an act primes environmental cues for action. Entering the planned space of action may, thus, be the needed impulse to realize the plans, which might remain good intentions in absence of these primed environmental cues.

TABLE 1: SOME INFORMATION PROCESSING DEPICTIONS OF CONSUMER CHOICE

Author(s)	Year	Sequence
Starch	1925	Seeing → Reading → Believing → Remembering→ Acting
Strong	1925	Awareness → Interest → Desire → Action
Lionberger, Rogers	1960 1962	Awareness → Interest → Evaluation → Trial → Adoption
Colley	1961	Unawareness → Awareness → Comprehension → Conviction → Action
Lavidge and Steiner	1961	Awareness → Knowledge → Liking → Preference → Conviction → Purchase (i.e. cognition → affect → conation)
McGuire	1969	Exposure → Attention → Comprehension → Yielding → Retention → behaviour
Howard and Sheth	1969	Attention → Brand Comprehension → Attitude → Intention → Purchase
Rogers and Shoemaker	1971	Knowledge → Persuasion → Decision → Confirmation
McGuire	1976	Exposure → Perception → Comprehension → Agreement → Retention → Retrieval → Decision making → Action
Engel, Blackwell and Kollat	1978	Perceived information → Problem recognition → Search [→] Evaluation of Alternatives → Beliefs → Attitudes → Intentions → Choice
Britt	1978	Exposing → Attending → Perceiving → Learning and Remembering → Motivating → Persuading → Desired Action
Foxall and Goldsmith	1994	Environment → Attentional and perceptual filter → Interpretation (involving experiences, beliefs, attitudes and goals held in short and long term memory) → Brand beliefs → Brand attitudes → Brand purchase intentions → Response
Rossiter and Percy	1997	Need arousal → Information and evaluation → Purchase → Usage

Source: (Foxall 2005, p. 27)

Taken together, our re-formulation of the uncertainty concept and the preceding discussion about the relationship of uncertainty and consumer search allow us to make the following propositions, which will serve as the basis for developing our research hypotheses and operationalizing the key concepts: Four conceptually distinct dimensions of uncertainty appear to influence consumer search behaviour. Knowledge uncertainty captures the brand knowledge related doubts while evaluation uncertainty captures the product category related (i.e. evaluative) doubts. Choice uncertainty encapsulates the doubts over committing to the alternative judged best. And, finally, implementation uncertainty captures the doubts related to seeing through the transaction. The first three uncertainties fit nicely with Newman's (1977) keen observation: search activity increases when the consumer believes that the purchase is important, there is a need to learn more, and s/he can easily obtain and utilize information. Thus, they show some promise towards accounting for the motivational, encoding, and selective search effects. Higher levels of KU motivate consumers to increase pre-purchase search, higher levels of EU discourages search through making learning new product information more difficult, and, finally, higher levels of CU encourages more extensive search as consumers have difficulties identifying diagnostic product attributes, especially when choice alternatives are near equally attractive (for a discussion of consumer underconfidence, see Alba and Hutchinson 2000, p. 133). Implementation uncertainty (IU) connects our uncertainty concept to consumer loyalty and its antecedent, trust. How IU operates on search depends on the decision strategy applied. When conjunctive decision models are applied, IU operates through constricting the consideration set as untrustworthy sellers are weeded out. In disjunctive, lexicographic, and compensatory strategies IU merely adds an item to the preferences structure.

To sum, existing literature on uncertainty has identified and tested two dimensions of uncertainty: knowledge uncertainty and choice uncertainty. Further, existence of a third dimension, evaluation uncertainty, has been suggested but not tested. Evaluation uncertainty promises to resolve the problem of less than perfect discriminant validity of the original uncertainty constructs, and is a promising candidate for a third dimension of uncertainty. Finally, implementation uncertainty promises to provide the means of accounting for purchase process related doubts that are projected prior to purchase decision. We will next discuss how these four dimensions fit with theoretical decision making frames.

The Decision Making Framework for Studying Uncertainty

Decision making and uncertainty have been linked since, at least, the early 20th century, when John Dewey (1910, p. 9, 112) recognized uncertainty as the necessary precondition – and sometimes a constraint of choice: "*Unless there is something doubtful ... there is merely apprehension, perception, recognition, not judgment. If the matter is wholly doubtful, if it is dark and obscure throughout, there is a blind mystery and again no judgment occurs.*" Dewey's formulation of the problem solving process, the complete act of thought, was among the first frameworks for investigating the individual decision making. He recognized five logically distinct steps, common elements found in all thinking: 1) a felt difficulty, 2) its location and definition, 3) suggestion of possible solution, 4) development by reasoning of the bearings of the suggestion, and 5) further observation and experiment leading to its acceptance or rejection; that is the conclusion of belief or disbelief. He also noted that the first

two steps "*frequently fuse into one*." (1910, p. 72)

John Dewey has heavily influenced consumer behaviour researchers, who have elaborated his basic scheme and suggested that the consumer as a decision maker undergoes several cognitive stages (see Table 1) during the purchase process. These information processing models often mix stages of decision making (e.g. problem recognition, and evaluation) with functions of the cognitive mechanism (e.g. awareness, perception, and retention) and acts of the purchase process (e.g. search, usage). Also, the consumer information processing models have been regularly criticized for not being testable. The sheer size of many of the models indeed complicates both their verification and application. As the consumer information processing models tend to incorporate much more information than is necessary for our analyses, we elect to turn to more parsimonious models of decision making.While John Dewey (1910) introduced the notion of decision making as a sequence of decomposed stages that converge on a solution, Herbert Simon (see e.g. 1960, p. 2) established the dominant model of the decision-making process as a three phase "intelligence-design-choice" sequence (Langley, Mintzberg et al. 1995), which was later supplemented with a fourth stage of "implementation" as many authors felt it significant enough to be shown separately (see e.g. Sprague Jr. and Carlson 1982, pp. 26-27). In the intelligence phase the decision maker identifies the available alternate strategies. He obtains, processes, and examines raw data for clues that may identify problems with the strategies.

In the design phase the decision maker determines and evaluates the consequences of following the alternative strategies and evaluates these sets of consequences. The word all is used advisedly as it is often impossible for the decision maker to identify all of the alternatives, or their consequences. This second phase of decision making is about inventing, developing, and analyzing the possible consequences. In the choice phase decision maker chooses his strategy and in the implementation phase he puts the chosen strategy to use.

Simon's depiction of the decision-making process is one model in the growing company of information processing and consumer choice models (see Table 2) most of which show some promise as a framework for consumer choice related uncertainty. We base our selection of the framework primarily on completeness and parsimony: consumer behaviour literature suggests the presence of four dimensions of uncertainty, which limits our choice alternatives to a handful of models, those with four identified stages. To choose among these models, we next turn to examine their content. Simon's model is a description of general decision making process as opposed to consumer purchase or information processing models, which mostly attempt to capture the sequence of acts in purchase process rather than focus on the distinctive stages of decision making as such. The model implicitly embraces the concept of uncertainty as ambiguity is the precondition for boundedly rational decision behaviour, and the stages of the model also closely match the dimensions of uncertainty we have identified through the review of consumer behaviour literature.

As it is our aim to identify the general dimensions of uncertainty facing consumers in any purchase, we deem that the model of decision-making process put forth by Simon best fits with this goal. The model suggests that four logically distinct dimensions can be identified in any decision. A measurement instrument for testing this is next developed and tested for assessing the reliability and validity of the model with a sample of 604 consumers.

TABLE 2: UNCERTAINTY CATEGORIES IDENTIFIED IN CONSUMER BEHAVIOUR LITERATURE

Decision Stage	***Uncertainty***		
	Dimension	*Observation*	*Reference*
Intelligence	Knowledge uncertainty (KU)	The authors coin the term *Usable Prior Knowledge* to account for relevant brand information held in memory.	(Punj and Staelin 1983)
		The authors coin the term *individual brand uncertainty* to account for brand information related doubts.	(Moorthy, Ratchford et al. 1997)
		search experience	(Park and Lessig 1981)
Design	Evaluation uncertainty (EU)	While the authors coin the term *knowledge uncertainty*, they actually define the concept in terms of doubts over one's capacity to evaluate information	(Urbany, Dickson et al. 1989)
		usage experience	(Park and Lessig 1981)
Choice	Choice uncertainty (CU)	The authors coin the term *choice uncertainty* to account for doubts over identifying the best choice alternative.	(Urbany, Dickson et al. 1989)
		The authors coin the term *relative brand uncertainty* to account for doubts of choice.	(Moorthy, Ratchford et al. 1997)
		response uncertainty (choice of the best alternative is equivocal) produces conflict and, subsequently, the motivation to resolve that conflict	(Lanzetta 1963, p. 262)
		ownership status	(Park and Lessig 1981)
Implementation	Implementation uncertainty (IU)	Prior memory structure captures "the *consumer's knowledge of the buying process* as well as the knowledge associated with [the product category] in general"	(Punj and Staelin 1983)
		Functional motives, including perceived value, order services, and convenience were the strongest motives in influencing catalog shopping for 2 different product classes. Several motives identified as important for catalog patronage by previous research were not as strong as these motives. In addition, 2 nonfunctional motives related to *company responsiveness* and *reputation* were comparable in strength to several functional motives.	(Eastlick and Feinberg 1999)
		Salient motives of males for catalog patronage consisted mainly of merchandise- and service-related. In contrast, females indicated that their *salient motives were convenience-oriented*	(Eastlick and Feinberg 1994)
		… branding, awareness, and *trust* remain important sources of heterogeneity among Internet retailers	(Brynjolfsson and Smith 2000)

Methodology

The paradigms for measurement development (Churchill 1979, Nunnally 1978) suggest an iterative process. Widely used instruments have several characteristics that promote their use: they are theory based, they are developed using established psychometric methods and they are confirmed for reliability and validity (Churchill 1979, Peter 1979, Nunnally 1978). Furthermore, they propose constructs that are intuitively appealing (Churchill 1979, Peter 1979, Nunnally 1978).

The measurement development process and item generation

Firstly, we studied in the pilot study the validity and the structural relationship of the uncertainty constructs and their effect on consumer search processes and pre-purchase search behaviour. The effect of individual differences and purchase situations on search behaviour is complex, often interactive and difficult to interpret and generalize about. Therefore, we chose as similar and consistent a group as possible for our observation research. Our response group consisted 56 of 12-15 year old teenagers from the same demographic area. The method we used in this pilot study was empirical observation. We choose this method in order to find out what people really do in a search, purchase and decision making situation, instead of just asking what they think they would do. We conducted observations during May 2004 on the school's premises. In the pilot study, we treated the knowledge and choice uncertainty as the constructs of uncertainty, but the first empirical analyses showed that there was a considerable need to separate the uncertainty constructs for more phases.

We conducted seven iterations together when creating the items of each uncertainty dimensions. After all the iterations, we attempt at an empirical assessment of the validity of the measurements instrument was made by using 17 experts (e.g. professors, ICT directors and ICT consultants) as a control group. With control group, we used a questionnaire consisting of questions concerning how respondents think that our proposals really measure different uncertainty in different phases of decision process by Simon (1957). This information was interpreted and used for assessing whether our main constructs and detailed items are valid and representative. Then, the control group commented on the detailed items included in the questionnaires and tried to improve them. After refining some details of the instrument on the basis of feedback, the advisory group approved the questionnaires.

Furthermore, we pre-tested our paper questionnaire by the consumers from different age and demographics to get feedback to refine the questionnaire. On our pre-test we got together 27 answers. We conducted our pre-test at half a year before sending the questionnaire. We conducted a survey for the period from May through June 2006. The respondents were obtained by drawing a random sample of 2000 Finnish people. The sample frame was restricted to people over 18 years of age. We used seven point scales where only the extreme points of each scale were labelled. Increments of the scales can thus be regarded as equal. The technique makes the scales more like interval scales and provides more justification for the use of parametric statistical analyses. In the final phase of measure developing process, we tested our uncertainty measures for reliability, content validity, predictive validity and construct validity.

Survey

To collect data, we conducted a survey and the respondents responded fairly actively, and we tallied 639 questionnaires of which 604 included all of the response to questionnaire. Thus, the response rate was 32 %. To check that our sample represented the Finnish population, we identified the demographic variables having a prominent role in relation to consumer search and compared our data on these with the latest census figures for the Finnish population.

Our respondents were from 15 to 80 years old Finnish people. The age profile in our sample corresponds well enough to Finnish population (see, Appendix A). Our respondents are 58.1 % males and 41.9 % females. The corresponding statistics of population in Finland were 49 % males and 51 % females. Because males are known to use more Internet than females, so our data obviously correspond to the current population of active Finnish Internet users quite well. The number of people with low education was also smaller in the sample than in the population in Finland. Furthermore, the people in our sample earned clearly more wealth than people in the Finnish population in average. Location of residence may effect on search behaviour in the Internet. Our respondents represent well Finnish population in average in location of residence. We think that our data corresponds to the current population of active Finnish Internet

users accurately and there are not problems to generalize the results of the study.

Results

Reliability

The reliability of a measure reflects high internal consistency: the detailed items (questions) measure the same thing. In this study the reliability of the constructs was assessed by using Cronbach´s Alpha reliability coefficient (Cronbach 1951).

Cronbach´s Alpha for the knowledge uncertainty variables was .89, for the evaluation uncertainty .89, for the choice uncertainty .86 and for the implementation uncertainty .80. All these coefficients are at least .80 regarded as sufficient for the basic research according to Nunnally 1978. The reliability of the developed scales is thus not a problem, at least not in this sample.

TABLE 3: RELIABILITY MEASURES

Construct name	*N*	*Number of indicators*	*Reliability*
Knowledge Uncertainty	604	4	0.89
Choice Uncertainty	604	6	0.89
Evaluation Uncertainty	604	4	0.86
Implementation Uncertainty	604	7	0.80

Content validity

Content validity means that we measure what we are supposed to measure. In other words, if we aim at a good measure of uncertainty constructs of different decision phases, we should be convinced that the measurement instrument includes the essential features of uncertainty (Churchill 1979). According to Nunnally (1978), content validity can be best assured by the procedures used to develop measures. 1) We achieved high content validity by a two phased research strategy which helped us in understanding the phenomena of uncertainty. 2) We also connected uncertainty measurement to the traditional decision making theory by Simon (1957) widely accepted by academic society. 3) In addition, we used a control group of 17 experts to provide feedback and develop our ideas. 4) Furthermore, addition to uncertainty measure tests, we pre-tested our paper questionnaire by 27 different age and demographics of consumers. After that we repair our questionnaire to be better understood by consumers. The above means clearly increased content validity, but were still adequate. Therefore, 5) Content validity was studied in the survey phase by analyzing correlations between the detailed items and the total uncertainty. 6) Further, we identified items that had low loadings and were not measuring what they were supposed to measure and drop them out. Correlations between total uncertainty and the detailed items are shown in table 4.

TABLE 4: CORRELATIONS BETWEEN THE ITEMS OF FOUR MAIN UNCERTAINTY DIMENSIONS AND THE UNCERTAINTY CONTROL VARIABLE.

	UNCERTAINTY ITEMS	*Mean*	*Std.dev.*	*Item to total uncertainty correlation*	*Significance*
	KNOWLEDGE UNCERTAINTY				
KU1	Uncertainty about the alternatives	2.919	1.734	0.29	*****
KU2	Uncertainty about the prices	3.254	1.810	0.26	*****
KU3	Uncertainty about different products	3.092	1.780	0.28	*****
KU4	uncertainty about where is the lowest prices	3.121	1.901	0.26	*****
	EVALUATION UNCERTAINTY				
EU1	Uncertainty of the main criteria on my choice	2.268	1.480	0.26	*****
EU2	Uncertainty of which attributes are the criteria	2.234	1.404	0.26	*****
EU3	Uncertainty of the most important criteria	2.298	1.424	0.29	*****
EU4	Uncertainty of ability to compare information	2.623	1.589	0.33	*****
EU5	Uncertainty of comparability of the information	2.533	1.474	0.32	*****
EU6	Uncertainty of availability of comparable information	2.570	1.482	0.30	*****
	CHOICE UNCERTAINTY				
CU1	Uncertainty to choose a product	2.032	1.412	0.33	*****
CU2	Uncertainty to choose a brand	2.200	1.500	0.31	*****
CU3	Uncertainty to choose an alternative	2.066	1.437	0.28	*****
CU4	Uncertainty to choose where to shop	2.189	1.296	0.28	*****
	IMPLEMENTATION UNCERTAINTY				
IU1	Uncertainty of having problems in purchasing	2.084	1.418	0.21	*****
IU2	Uncertainty to go to the store	1.976	1.402	0.10	**
IU3	Uncertainty of product availability at purchase time	2.880	1.762	0.08	**
IU4	Uncertainty of fulfilment of delivery	3.482	1.978	0.15	****
IU5	Uncertainty of having problems in purchasing the product	2.706	1.758	0.31	*****
IU6	Uncertainty of fulfilment on delivery price	2.574	1.790	0.14	****
IU7	Uncertainty of fulfilment of adds promised delivery	2.847	1.876	0.20	****

(Significance levels ***** =<.0001,**** =0.001, *** =0.01, ** =0.1)

On the basis of detailed item to total uncertainty correlations, the questionnaire could be improved by dropping out some items. Therefore, to improve our measurement instrument, we drop out the detailed item below correlation value of 0.1. In this study, Content validity is good and we are convinced that the measurement instrument includes the essential features of uncertainty.

Predictive validity

Predictive (or Nomological) validity assesses whether an item measured is associated with the main construct. Predictive validity in our case means that the measurement instrument distinguishes different uncertainties and converges with alternative measures of uncertainty. There are two cases in which correlating one test with another will provide definite information. If correlation between the two tests is nearly perfect, close to .90, then the two tests are almost identical and should approximately equal in predictive effectiveness

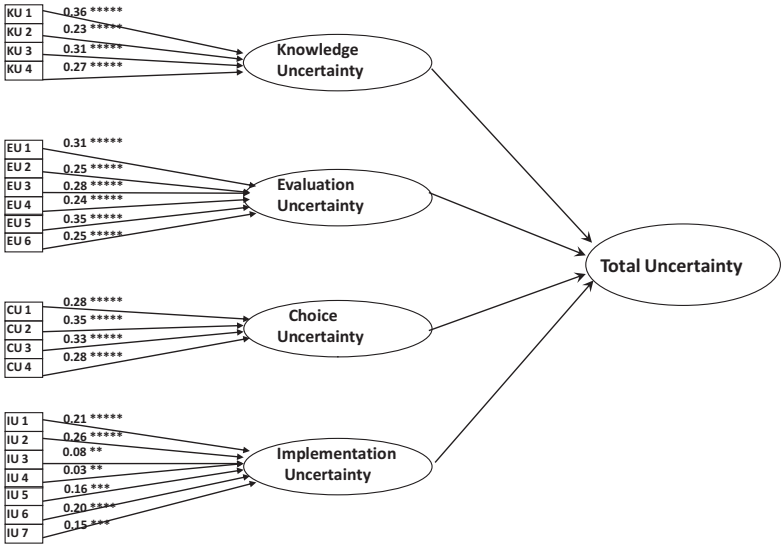
for any assessment. On the other extreme, if the correlation between two tests is very low, approaching zero correlation, it is certain that the two tests are measuring different things. High correlations reflect high predictive validity. However, if correlations are very high it also may mean that new scales provide the same information as existing measures and may therefore be redundant. Correlations between the developed scales and control variables were used to study the predictive power of each construct. Item to control variables correlations are shown in figure 1 for each of the four constructs of uncertainty.

When created the questions of control variables we conducted a large literature review. Total uncertainty is measured by question of "Purchasing consist a lot of uncertainty". We used literature of Stigler 1961 and Urbany et al. 1989 to create the control variable to measure the "Total Knowledge uncertainty" by question of "I had uncertainty of my own knowledge about the alternatives". Total Evaluation uncertainty is measured by question of "I had Uncertainty about my decision criteria to conduct my choice" (Urbany et al. 1989). Total Choice uncertainty is measured by question of " I was uncertain of which product to choose" (Lanzetta 1963, Lanzetta and Driscoll 1968, Sieber and Lanzetta 1964, Urbany et al. 1989). Total Implementation uncertainty is measured by question of " I was uncertain of being able to purchase the product I have chosen already in my mind".

Correlations between knowledge uncertainty scale and its control variable are between .27 and .36, and the values are significant at $p<.0001$ level. Correlations between evaluation uncertainty scale and its control variable are between .24 and .35, and the values are significant at $p<.0001$ level. Correlations between choice uncertainty scale and its control variable are .28 and .35, and the values are significant at $p<.0001$ level. There is larger scale of correlation values between implementation uncertainty scale and its control variable, the range of values vary between .03 and .26. Four values are above .15 and two of them are below .10. All correlations, except IU3 and IU4, are quite high thus accessible. Implementation uncertainty scale is significant at $p<.001$ level. We drop out the item of IU3, because of low content validity, and also, low predictive validity. We will drop out also the item of IU4, because the lowest predictive value of .03.

Correlations between the developed scales and control variables were used to study the predictive power of detailed measures of each uncertainty dimensions. In this study, the predictive power of detailed measures of KU, EU and CU are excellent. The values for KU, EU and CU are significant at $p<.0001$ level. The predictive validity of Implementation Uncertainty is sufficient, when we dropped out IU3 and IU4.

FIGURE 1: PREDICTIVE VALIDITY



Construct validity

Construct validity, in this case, means that the underlying structure of the developed construct is found also in reality. A most powerful method for analyzing construct validity is factor analysis. We have 21 variables describing uncertainty found by large literature review. Then we did the factor analysis with principal component method for those 21 uncertainty variables and created a general uncertainty point for consumer pre-purchase uncertainty with program of SAS Enterprise Quide 4.

We used seven point scales where only the extreme points of each scale were labeled. The technique makes the scales more like interval scales and provides more justification for the use of parametric statistical analyses. First we carried out a factor analysis. The results are: the Eigenvalue for the first Factor is 9.833 and it explains 46,8% of all uncertainty. The Eigenvalue for the second factor is 1.879 and these two factors explains 55,8 % of all uncertainty. The four first eigenvalues explains 68,7 % of all uncertainty.

TABLE 5: EIGENVALUES OF THE CORRELATION MATRIX

Eigenvalues of the Correlation Matrix			
	Eigenvalue	*Proportion*	*Cumulative*
1	9.833	0.468	0.468
2	1.879	0.090	0.558
3	1.659	0.079	0.637
4	1.051	0.050	0.687

TABLE 6: FACTOR ANALYSIS LOADINGS OF UNCERTAINTY VARIABLES (NO ROTATION)

UNCERTAINTY ITEMS	Factor 1	Factor 2	Factor 3	Factor 4	*Communality Estimates*
KU1 Different alternatives	***0.691***	0.473	-0.231	-0.142	***0.774***
KU2 The different prices of products	***0.664***	0.562	-0.107	-0.204	***0.810***
KU3 The different products	***0.689***	0.522	-0.213	-0.160	***0.818***
KU4 Where to shop	***0.653***	0.441	-0.150	-0.263	***0.713***
EU1 The main criteria on my choice	***0.688***	-0.137	-0.218	0.018	***0.539***
EU2 Which attributes are the criteria	***0.708***	-0.147	-0.337	0.132	***0.654***
EU3 The most important criteria	***0.716***	-0.147	-0.404	0.201	***0.738***
EU4 Own ability to compare information	***0.764***	-0.059	-0.263	0.191	***0.692***
EU5 The information comparability	***0.759***	-0.145	-0.277	0.300	***0.764***
EU6 Availability of comparable information	***0.755***	-0.085	-0.228	0.199	***0.669***
CU1 Difficult to choose product	***0.685***	-0.357	0.010	-0.170	***0.625***
CU2 Difficult t to choose brand	***0.689***	-0.306	0.213	-0.396	***0.770***
CU3 Difficult to choose an alternative	***0.716***	-0.296	0.144	-0.349	***0.742***
CU4 Difficult to choose where to shop	***0.756***	-0.275	0.077	-0.295	***0.740***
IU1 Problems in purchasing	***0.719***	-0.259	0.221	-0.010	***0.633***
IU2 Problems to go to the store	***0.685***	-0.292	0.223	-0.061	***0.607***
IU3 Product availability at purchase time	***0.548***	0.270	***0.508***	0.120	***0.646***
IU4 Fulfilment of delivery of the product	***0.458***	0.394	***0.526***	0.110	***0.654***
IU5 Problems in purchasing the chosen product	***0.692***	0.083	0.372	0.183	***0.658***
IU6 Fulfilment on delivery price	***0.649***	-0.004	0.371	0.318	***0.660***
IU7 Fulfilment of adds promised delivery	***0.613***	0.086	0.151	0.332	***0.516***
Variance explained by each Factor	***9.833***	***1.879***	***1.659***	***1.051***	

In table 6 we are able to see that all uncertainty variables load to the first Factor. The variance explained by the first factor is 9.833, which is very high indeed. All values above .50 are acceptable and thus, all of our loaded factor solution values in Factor 1 are acceptable except IU4. Thus, we dropped out the variable of IU4. All of the communalities are more than .60, except two and they still is acceptable and over .50. Thus, all communalities are very good in value. Next, we carried out a Factor analysis with orthogonal varimax rotation to get visible the different uncertainty dimensions loadings.

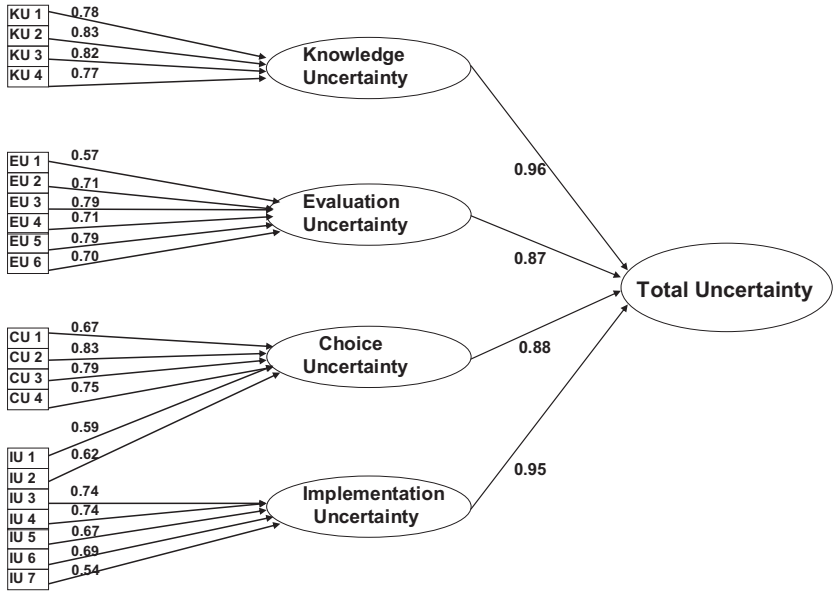
TABLE 7: FACTOR ANALYSIS LOADINGS OF FOUR DIFFERENT UNCERTAINTY VARIABLES WITH VARIMAX ROTATION

UNCERTAINTY items		*Factor 1* *EU*	*Factor 2* *CU*	*Factor 3* *KU*	*Factor 4* *IU*
KU2	Different alternatives	0.336	0.138	***0.778***	0.189
KU3	The different prices of products	0.196	0.142	***0.825***	0.266
KU4	The different products	0.303	0.124	***0.817***	0.207
KU5	Where to shop	0.212	0.226	***0.767***	0.170
EU1	The main criteria on my choice	***0.567***	0.380	0.252	0.100
EU2	Which attributes are the criteria	***0.709***	0.299	0.239	0.069
EU3	The most important criteria	***0.788***	0.246	0.232	0.054
EU4	Own ability to compare information	***0.709***	0.265	0.284	0.198
EU5	The information comparability	***0.794***	0.242	0.176	0.211
EU6	Availability of comparable information	***0.695***	0.278	0.247	0.216
CU1	Difficult to choose product	0.394	***0.667***	0.101	0.122
CU2	Difficult t to choose brand	0.150	***0.825***	0.178	0.187
CU3	Difficult to choose an alternative	0.227	***0.789***	0.197	0.171
CU4	Difficult to choose where to shop	0.310	***0.751***	0.227	0.168
IU1	Problems in purchasing	0.356	***0.591***	0.064	0.391
IU2	Problems to go to the store	0.316	***0.621***	0.045	0.346
IU3	Product availability at purchase time	0.030	0.205	0.250	***0.735***
IU4	Fulfilment of delivery of the product	-0.070	0.099	0.303	***0.740***
IU5	Problems in purchasing the chosen product	0.271	0.314	0.185	***0.672***
IU6	Fulfilment on delivery price	0.341	0.258	0.045	***0.689***
IU7	Fulfilment of adds promised delivery	0.427	0.126	0.152	***0.543***
	Variance explained by each Factor	***4.280***	***3.886***	***3.241***	***3.015***

The rotated solution revealed the four dimensional structure of uncertainty as we expected. Each factor has clearly one dominant variable and on the other hand, the variances of all variables the four factor solution explain, vary from 0.516 to 0.818. Thus more than 50% of the variance of each variable is explained by the four factor solution. Moreover, it means that there is no reason to drop any variable from the analysis. The factors can be easily named according to the variables with the highest loadings. The factors are called "Evaluation Uncertainty (FEU)", "Choice Uncertainty (FCU)", Knowledge Uncertainty (FKU)", and "Implementation Uncertainty (FIU)". The-classification of some variables is clearly needed. The loadings IU1 and IU2 are highest loaded on factor FCU, even if they originally grouped to contribute to Implementation Uncertainty" Thus those variables are associated to that factor ("Choice Uncertainty").

The factor solutions illustrate good construct validity for all of the four uncertainty scales because all values are acceptable and above .50. Most of the values are higher than .70, which is a very good result.

FIGURE 2. A SECOND ORDER FACTOR MODEL WITH FOUR FIRST ORDER FACTORS (Factors order is changed to follow the consumer decision making process.)



Conclusion of results

In the final phase of measure developing process, we tested our uncertainty measures for reliability, content validity, predictive validity and construct validity.

The reliability of a measure reflects high internal consistency. All these coefficients are between.80 and .89. Thus, the detailed items measure the same thing (Cronbach 1979).

According to Nunnally 1979, content validity can be best assured by the procedures used to develop measures. We achieved high content validity by a two phased research strategy which helped us in understanding the phenomena of uncertainty and we used the procedures used to develop measures widely accepted by academic society (Churchill 1979, Peter 1979, Nunnally 1978). We also connected uncertainty measures to the traditional decision making theory by Herbert Simon (1957). In addition, we used a control group to provide feedback and develop our ideas. Furthermore, addition to uncertainty measure tests, we pre-tested our paper questionnaire by a different age and demographics of consumers. We repair our questionnaire to be better understood by consumers and to be a lot of shorter. In addition, content validity was studied in the survey phase by analyzing correlations between total uncertainty and the dimensions of uncertainty, and also total uncertainty and the detailed items measuring different uncertainties. In this study Content validity is good for all main constructs and for most of

the items, and we are convinced that the measurement instrument includes the essential features of uncertainty.

Predictive validity in our case means that the measurement instrument distinguishes different uncertainties and converges with alternative measures of uncertainty. In this study, predictive validity is analyzed by correlations to control variable in each dimensions of uncertainty. All items and control variables correlations, except IU3 and IU4, are acceptable and most are significant $p<.0001$ level. Thus, we will drop them out.

Construct validity, in this case, means that the underlying structure of the developed construct will be found also in reality. This can be analyzed with factor analysis.

Most of the values are higher than .70, which is a very good result. However, we shift now the values of IU1 and IU2 to Choice Uncertainty. Although, considering the content of variables IU1 "Problems in purchasing" and IU2 "Problems to go to the store", they are more related to choice than implementation uncertainty. All values above .50 are acceptable and thus, all of our loaded factor values are good, when we shift the the values of IU1 and IU2 to Choice Uncertainty.

TABLE 8. THE FINAL MEASURES OF UNCERTAINTY

	UNCERTAINTY	**Included to the scale**	**Explanation, if not**
	KNOWLEDGE UNCERTAINTY		
KU1	Uncertainty about the alternatives	Included	
KU2	Uncertainty about the prices	Included	
KU3	Uncertainty about different products	Included	
KU4	uncertainty about where is the lowest prices	Included	
	EVALUATION UNCERTAINTY		
EU1	Uncertainty of the main criteria on my choice	Included	
EU2	Uncertainty of which attributes are the criteria	Included	
EU3	Uncertainty of the most important criteria	Included	
EU4	Uncertainty of own ability to compare information	Included	
EU5	Uncertainty of comparability of the information	Included	
EU6	Uncertainty of availability of comparable information	Included	
	CHOICE UNCERTAINTY		
CU1	Uncertainty of having difficulties to choose product	Included	
CU2	Uncertainty of having difficulties t to choose brand	Included	
CU3	Uncertainty of having difficulties to choose an alternative	Included	
CU4	Uncertainty of having difficulties to choose where to shop	Included	
IU1	Uncertainty of having problems in purchasing	Included	Sifted to CU
IU2	Uncertainty of having problems to go to the store	Included	Sifted to CU
	IMPLEMENTATION UNCERTAINTY		
IU3	Uncertainty of product availability at purchase time	Deleted	Low content and predictive validity
IU4	Uncertainty of fulfilment of delivery of the product	Deleted	Low construct and predictive validity.
IU5	Uncertainty of having problems in purchasing the product	Included	
IU6	Uncertainty of fulfilment on delivery price	Included	
IU7	Uncertainty of fulfilment of adds promised delivery	Included	

Discussion

In this paper, we studied the presence of uncertainty in consumer decisions. Our purpose was to show that uncertainty has a multidimensional nature and to identify those dimensions. Our initial idea was to associate those dimensions to a classical decision making process originally proposed by Herbert Simon (Simon 1960) completed with the Implementation phase proposed by Sprague and Carlson (1982). We carried out an empirical survey in which we used 21 questions to describe various features of uncertainty. The questions were based on literature review. Each question was subjectively associated to one of the uncertainty dimension, we expected to reveal. Our empirical findings confirmed our initial idea. Using the rotated solution of factor analysis, we were able to recognize the uncertainty dimensions: *knowledge uncertainty, evaluation uncertainty, choice uncertainty, and implementation uncertainty* as we expected. However, some of the variables required to reclassification.

Our results provide a pattern of questions which all can be used to characterize a certain dimension of uncertainty. The use of all variables can be used to find "Total Uncertainty", if one dimensional measure is needed. However, we recommend to use four dimensional solution, because "fine tuning" will be lost if only one dimensional measure is used.

To summarize our contribution, we have introduced the decision making process (Simon 1957) as the basis to study uncertainty in relation to consumer behaviour in electronic markets. We have also complemented the previously tested uncertainty dimensions (KU, CU) with two additional constructs: (1) Evaluation uncertainty has its origin in previous empirical studies of uncertainty in consumer behavioural context (Urbany et al. 1989), while (2) implementation uncertainty is derived from the generic model of the decision making process (Simon 1957).

In this paper, measurement scales have been tested for reliability and validity with a sample of 639 consumers. The resulting measurement instrument can be used in future studies using decision making theory and bounded rationality, in particular, as their theoretical foundation.

Limitations

Data was collected in a specific context. Our sample consists of Finnish citizen, who are used to advanced technology, well education, well-being. Limitations of data collection method: We used two times pre-tested questionnaires, but still it is possible that questions may have been understood inadequately. We conducted a survey in a context of travel information and travel purchase. General decision making approach is useful to understand consumer buying behaviour when the purchase is a real decision making situation. However, when a purchase is small or otherwise unimportant to the buyer, it does not apply. In many cases earlier experience and habits may dominate decisions. Similarly, if the purchase is relatively big and important for the buyer it may have some limitations. For example, if consumer is buying a house, the process may have many characteristics that link it merely to a learning process. In some cases when the buying decision is dependent on many decision makers, negotiation processes might be suitable. This may occur, for example, in a case when a family wants to buy a holiday trip, but part of the family members would like to go for skiing, part of them would prefer sunny beaches.

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APPENDIX A: The Profile of Respondents

		Frequency	Sample Percentage	Population Percentage*
Gender				
Valid	Male	351	58.1	48.8
	Female	253	41.9	51.2
Total **		604	100	
Missing Values		35	5.5	
Education				
Valid	Comprehensive school education	127	21.3	41.5
	Upper secondary general education	50	8.4	22.9
	Vocational and professional education	159	26.7	12.7
	Polytechnic education	163	27.4	12.6
	University education	96	16.1	10.3
Total		595	99.9	
Missing Values		44	6.9	
Income	Euro /Year			
	– 9999	71	12.9	28.4
	10000 – 24999	147	26.7	39.1
	25000 – 49999	191	34.7	24.7
	50000 –	141	25.6	5.1
Total		550	99.9	
Missing Values		89	13.9	
Community Size				
	The Metropolitan area	130	22.5	18.3
	Town, > 45,000 inhabitants	123	21.2	21
	Town, < 45,000 inhabitants	160	27.6	21.1
	Urban or semi-urban municipality	39	6.7	16.5
	Rural Municipality	127	21.9	23.1
Total		579	99.9	
	Can´t choose of those	8	1.4	
# of Non-Missing Values		587		
Missing Values		52	8.1	
Sample Size		639		

* Statistics Finland (2004)

Uncertainty is the Other Side of the Coin of Information Online Search

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Abstract

Consumers pre-purchase information search is an essential part of consumers´ online buying and decision making process. There are nearly 60 factors that have been found to have an influence on consumer pre-purchase information search.
In the literature, uncertainty has been established as the motive of consumer search. Uncertainty is a concept that provides a theoretical frame to link online search research to consumer buying behaviour research, and decision making research.

We base our study on Beatty and Smith ´s (1987) research of External search determinants. In this paper, we studied 1) how uncertainty is related to the external search determinants in online purchase and 2) what kind of uncertainty consumers perceive when purchasing online.

We found that experience, education or demographic background does not have an influence on consumer perceived uncertainty. All consumers perceive uncertainty in the general decision making phases by Simon 1957.

1. Introduction

Consumers´ pre-purchase information search is an essential part of consumer decision making process [8], [11], [23], [28], [45], [48]. There have been three major theoretical streams of consumer information search in the literature: the psychological/motivational approach, the economics approach and the consumer information processing approach [48].

There are nearly 60 factors that have been found to affect consumer pre-purchase information search [48], [52]. According to Srinivasan and Rachford [52], these factors can be divided into three dimensions: Environmental factors, situational factors and factors of consumer characteristics.

In the past decades, some researchers have modelled the relationships among these factors influencing the consumer search behavior [34], [48], [52], [4], [47], [40], [48]. Schmidt and Spreng have provided a theoretically based model, and a set of four factors that mediate the effects of 20 factors of external search [48]. Those four factors are based on two theoretical perspectives of external information search: the psychological and information processing perspective, and the economics approach [48].

In the past decades, some researchers have made attempts to model the relationships and the factors influencing the consumer search behavior [34], [48], [52], [4], [47], [40]. However, there are only a few studies to research consumer felt uncertainty in online purchase behavior [38], [39]. We base our study on Beatty and Smith ´s (1987) research of External search determinants, because it is a comprehensive model of factors to influence consumer search behavior and it is based on an extensive literature review.

Uncertainty has been established as the motive of consumer search [53], [55], [8]. It is a concept that can be used to link electronic markets research to economic, consumer behaviour, and decision-making research facilitating the creation of a fuller picture of the effects electronic markets may have on consumer search and purchase behaviour. The concept of uncertainty provides us a coherent theoretical frame to explore consumer search in electronic markets. Uncertainty, on the other hand, is also the prime concept linking consumer search and decision-making theories [53], [31], [8], [42]. Every day, consumers make decisions regarding choice, purchase and the use of products and services. These decisions are often important to consumers and thus difficult to make. Consumers often perceive uncertainty while making decisions [31], [35], [55], [58], [59], [41], [27] or making purchases on the Internet [60], [61], [62], [34], [59], [19], [49]. Greater uncertainty should lead to more extensive search behavior [35].

Conceptually uncertainty is close to concepts such as knowledge, familiarity and confidence often related to consumer search. It can be said that uncertainty and knowledge represent two sides of the same coin. Knowledge embodies what is known while uncertainty refers to the difference of desired and perceived state of knowledge. Hence, uncertainty relates consumers information processing. The strength of the concept of knowledge is that it can be modelled as inner organization of information, e.g. memory structures. Its weakness lies in its ambiguous relationship with overt consumer search behaviour, for search is motivated by perceived lack of knowledge, not knowledge as such [55]. While uncertainty has received a lot of attention in general decision making literature [22], relatively seldom has it been targeted directly in consumer behaviour literature.

In this paper, we assume online purchasing process as a search process, linking it into a search theory base and the general decision making phases by Simon 1957.

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Our research questions are: 1) How uncertainty is related to the external search determinants in online purchase, and 2) What kind of uncertainty consumers perceive when purchasing online.

In the body of this paper, we will first discuss the factors identified behind the consumer pre-purchase information search in consumer behavioral literature. Secondly, we will study uncertainty concepts and link uncertainty to the general decision making phases [53]. Thirdly, we discuss the method and uncertainty item generation. After that, we represent the results. Finally we´ll conclude how uncertainty and search behaviour are related and what kind of uncertainty consumers perceive in the online purchase.

2. Consumer Online Search Behavior

There have been three major theoretical streams in consumer information search literature [48]. The first is the psychological/motivational approach, which incorporates the individual, the product class, and the task related variables such as beliefs and attitudes [4], [21] and involvement [4]. The second is the economics approach, which uses the cost-benefit framework to study information search [3], [48]. The economic theory of search states that consumers weight the cost and benefits of search when making search decisions. The third one is the consumer information processing approach which focuses on memory and cognitive information processing theory [48].

Search is often characterized by the locus of search activity. Information search behavior can be defined as "the motivated activation of knowledge stored in memory or acquisition of information from the environment" [23]. As the definition suggests, information search can be either an internal or external task. Internal search is based on the retrieval of knowledge from memory. On the other hand, external search consists of collecting information from the marketplace [23].

In some models, the information search variables can be divided into three dimensions [52]: Environmental-, situational- and consumer characteristics factors. The factors of environment are: difficulty of the choice task, number of alternatives and complexity of product [52]. The choice task related variables such as beliefs and attitudes have been studied by [4], [23]. The most important situational factors are previous satisfaction, time constraints, perceived risk [52]. Generally, it is believed that consumers tend to acquire information as a strategy of certain risk reduction efforts [8]. However, consumers are likely to search for information as long as they believe that the benefits of acquiring information outweigh the cost of information search as indicated in "the economics of information" theory [55]. Consumer characteristics factors are related to education, prior knowledge and involvement [52]. Prior knowledge in the theoretical framework is presented by two components: familiarity and expertise within the "dimensions of prior product knowledge"[1]. Experience or expertise works through both subjective and objective knowledge. The multi-dimensional prior knowledge construct utilized in the theoretical framework was initially developed by Alba and Hutchinson 1987 in order to better define and understand the construct itself and the effects on consumer decision making and information search behaviour.

We base our study on Beatty and Smith ´s (1987) research of External search determinants, because it is a comprehensive model of factors to influence consumer search behavior and it is based on an extensive literature review.

3. Uncertainty

3.1 The origin of uncertainty concepts

Stigler, in his seminal paper on economics of information, established that uncertainty is the driving force behind consumer search. Changing identity of sellers and buyers, and fluctuation in supply and demand result in uncertainty since information becomes obsolete [55].

Urbany et al. [59] suggested that uncertainty is a multidimensional construct, and may have a more complex effect on consumer search, conditional to the dominant form of uncertainty involved in the purchase decision. They distinguished two types of uncertainty, labelled knowledge uncertainty (KU) and choice uncertainty (CU). Knowledge uncertainty (KU) captures doubts consumers have about their own ability to judge sellers and products well enough to execute rational product comparisons [59]. Choice uncertainty (CU) arises from the conflict about which alternative to choose [35], [58], [59]. While the former construct is close to the original idea of uncertainty put forth by Stigler [55], the latter is reminiscent of "response uncertainty" coined by Lanzetta [35], who referring to Berlyne [6] stated that uncertainty occurs when the "choice of the best alternative is equivocal" in the context of resolving a conflict. Urbany et al. [59] mentioned there might exist evaluation uncertainty, but did not clarify it further.

Later, Moorthy et al. (1997) examined uncertainty as a central factor of consumers' problem framing and suggested that some degree of both knowledge and choice uncertainty are necessary antecedents of search as "in the common situation in which the consumer has brand-specific prior distributions [41]. Whether the consumer searches at all, depends not only on involvement, search cost, and individual brand uncertainty, but also on whether there is relative brand uncertainty [41]. In their terminology, individual brand uncertainty is close to what Urbany et al. [59] mentioned

as knowledge uncertainty and relative brand uncertainty close to choice uncertainty [41], [59].

3.2 Uncertainty linked to Decision Making Theory by Simon (1957)

In consumer behaviour literature, there are many models regarding information processing (Rogers and Shoemaker 1971,Howard and Seth 1969, McQuire 1976, Rossiter and Percy 1997, Foxall and Goldsmith 1994, Engel, Blackwell and Kollat 1978). As the consumer information processing models tend to incorporate much more information than is necessary for our analyses, we elect to turn to more parsimonious and general model of decision making. Herbert Simon´s depiction of the decision making process is one model of information processing and consumer choice models. Simons´ model is a description of general decision making process which focus on the distinctive stages of decision making as such. The stages of the model also closely match the dimensions of uncertainty we have identified through the large literature review of consumer behaviour literature.

The model suggests that four logically distinct dimensions can be identified in any decision. The task of decision making involves three steps by Simon [53]: 1) listing of all the alternative strategies; 2) comparative evaluation of these sets of consequences that follow upon each of these strategies, 3) Choice of the alternative strategies. According to Sprague and Carlson, the choice is made and also implemented in this phase [54]. Although the third phase includes implementation, many authors feel that it is significant enough to be shown separately, as a fourth phase of this decision making process. We will use this extended model of four phases.

3.2.1 Intelligence Phase – Knowledge Uncertainty

In the intelligence phase, consumers are listing of all the alternative strategies and they examine the raw information [53]. In other words, we are searching the environment for information for decisions [54]. In this intelligence phase of decision making, we see contribution to Stigler's Knowledge uncertainty as well as Urbany et al. study of KU [55], [59]. We define Knowledge uncertainty (KU) as uncertainty regarding what is known about the alternatives of the specific decision problem. Knowledge uncertainty may also be related to uncertainty over how to acquire the necessary information to make a choice.

3.2.2 Design – Evaluation Uncertainty

In Simon´s second decision making phase (Design) the consumer determinates all of the consequences that follow upon each strategy and evaluates the sets of consequences [53]. In this design phase we invent, develop, and analyze the possible consequences [53]. In other words, consumers process to understand the current problem, they evaluate the alternatives and the attributes to generate solutions [54]. In this design phase of decision making, we see contribution to Evaluation uncertainty. Evaluation uncertainty (EU) reflects uncertainty of how to integrate the information available to form judgements about brands or alternatives. We propose that if evaluation uncertainty is high, consumers will have difficulties in comparing information. Evaluation uncertainty occurs when consumers are not able to measure or compare different alternatives and value criteria.

3.2.3 Choice Phase – Choice uncertainty

In the choice phase of Simon´s decision making theory, consumers select a particular course of action, from the available ones. Consumers are often faced with a large number of alternatives and a great deal of information available from many sources. In this choice phase of decision making, we see contribution to Lanzetta´s Choice uncertainty [35], [36]. Choice uncertainty (CU) means uncertainty about which alternative to choose [58, 59]. Lanzetta says that uncertainty occurs when the "choice of the best alternative is equivocal" in the context of resolving a conflict [35], [36]. Urbany et al. [59] defined choice uncertainty as uncertainty regarding which alternative to choose. According to them [59], choice uncertainty covers questions such as what and where to buy, and exists as a separate construct in the consumers' mind.

3.2.4 Implementation Phase - Implementation Uncertainty

Implementation phase is important to consumers and there are many uncertainties, especially in online purchasing because of immaterial character of purchase [56]. In this implementation phase of decision making, we see contribution to a new construct of Implementation uncertainty. Implementation uncertainty (IU) means uncertainty about fulfilment of purchase. We did not find earlier literature the Implementation uncertainty. Implementation phase is important to consumers and there are many uncertainties regarding this phase of decision. In this study, we describe implementation uncertainty as: 1) uncertainty of having problems in purchasing, 2) uncertainty of product availability at shopping time, 3) uncertainty of the fulfillment of the delivery.

4 Method

4.1 Item generation for uncertainty

In the first stage of the analyses we treated the knowledge and choice uncertainty as the constructs of uncertainty, but the first empirical analyses of our pilot study [38], [39] showed that there was a considerable need to separate the uncertainty constructs. In response to

the feedback on our pilot study, we went back to the literature and sought better measures of uncertainty.

Table 1: The references we used to create items of general uncertainty.

UNCERTAINTY ITEMS	REFERENCES
KNOWLEDGE UNCERTAINTY	[55] , [59], [4] [41], [24], [33], [47], [12]
1. Uncertainty about the alternatives	[59] ,[41] , [33] [40] , [4], [48]
2. Uncertainty about the prices	[55] , [58] , [13], [15], [57] , [43] , [33] , [32]
3. Uncertainty about different products	[55] , [1], [21]
4. Uncertainty about where the lowest prices are	[59], [55] , [32]
EVALUATION UNCERTAINTY	[59] , [41], [1], [12] , [24]
5. Uncertainty of the main criteria in my choice	[59] , [1], [40] , [4]
6. Uncertainty of which attributes are the criteria	[59] ,[55] , [40] , [4]
7. Uncertainty of the most important criteria	[59], [41], , [40] , [4]
8. Uncertainty of one´s own ability to compare information	[21] ,[1] , , [41] , S [48]
9. Uncertainty of information comparability	[59], [1], [12] , [30] , [59]
10. Uncertainty of availability of comparable information	[59], [30]
CHOICE UNCERTAINTY	[35] , [50] , [36] , [59], [41]
11. Uncertainty of difficulty to choose a product	[35] , [50], [4], [21] , [36] , [11]
12. Uncertainty of difficulty to choose a brand	[59], [41] , [33]
13. Uncertainty of difficulty to choose an alternative	[59], [1], [33]
14. Uncertainty of difficulty to choose where to shop	[59], [33]
IMPLEMENTATION UNCERTAINTY	[41],[56]
15. Uncertainty of having problems in purchasing	[59], [56] , [4]
16. Uncertainty of having problems to go to the store	[48] , [56], [4]
17. Uncertainty of product availability at purchase time	[59], [56]
18. Uncertainty of fulfilment of delivery of the product	[41] , [56]
19. Uncertainty of problems in purchasing the product	[59] , [41], [56], [21] , [4]
20. Uncertainty of fulfilment on delivery price	[55] , [56]
21. Uncertainty of fulfilment of adds promised delivery	[25] , [56]

Table 1 shows the references we used to create items of general uncertainty. As said above, uncertainty has been, however, studied indirectly through other constructs, such as subjective knowledge, experience, and confidence. References concern knowledge as well as uncertainty, because uncertainty and knowledge represent two sides of the same coin.

We conducted seven iterations together when creating the items of each uncertainty dimension. After the iterations, we attempted at an empirical assessment of the validity of the measurements instrument by using experts as a control group. The group consists of 17 experts all together: 4 professors, consultants and directors of ISS). This information was interpreted and used for assessing whether our main constructs and detailed items were valid and representative. Then, the control group commented on the detailed items included in the questionnaires and tried to improve them. After refining some details of the instrument, the advisory group approved of the questionnaires. Furthermore, we pre-tested our paper questionnaire by consumers from different age groups and demographics to get feedback to refine the questionnaire so that consumers understand the questions in the same way. In our pre-test we got 27 answers together. After that we enhanced our questionnaire to be better understood by consumers and to be a lot shorter.

4.2 Survey

The next step was a mail survey to test the uncertainty measure scales. We used seven point scales where only the extreme points of each scale were labelled. Increments of the scales can thus be regarded as equal. The technique makes the scales more like interval scales and provides more justification for the use of parametric statistical analyses. To collect data, we conducted a survey and the respondents responded fairly actively, and we tallied 639 questionnaires. Thus, the response rate was 32 %, which we deem adequate. Yet, to be more assured that our sample is representative of the Finnish people, we identified the demographic variables having a prominent role in relation to consumer search and compared our data on these with the latest census figures for the Finnish population.

4.3 The profile of the respondents

The age profile in our sample corresponds well enough to Finnish population. Our respondents were from 15 to 80 years old Finnish people. Our respondents were 55% males and 40 % females. The corresponding statistics of population in Finland were 49 % males and 51 % females. Males are known to use more internet than females, so we see that our data corresponds to the current population of active Finnish internet users quite well. More educated people were more active to respond to our questionnaire. Likewise, people with low education responded a little less than average population in Finland. However, in our sample the group of people with higher income is bigger than in average Finnish population. Location of residence may affect search behavior on the internet. Our respondents represent well Finnish population in average in location of residence.

We think that our data corresponds to the current population of active Finnish internet users accurately.

5. Results

5.1 Developing the General Uncertainty Point

The first step of analysis was to develop uncertainty point with the principal components analysis with program of SAS Enterprice quide 4. We have 21 variables describing uncertainty found by an extencive literature review and item generation process.

Table 2: Principal Component loadings for uncertainty variables

Uncertainty Variables	PC 1	PC 2	PC 3	Communality Estimates
1	0.691	0.473	-0.231	0.774
2	0.664	0.562	-0.107	0.810
3	0.689	0.522	-0.213	0.818
4	0.653	0.441	-0.150	0.713
5	0.688	-0.137	-0.218	0.539
6	0.708	-0.147	-0.337	0.654
7	0.716	-0.147	-0.404	0.738
8	0.764	-0.059	-0.263	0.692
9	0.759	-0.145	-0.277	0.764
10	0.755	-0.085	-0.228	0.669
11	0.685	-0.357	0.010	0.625
12	0.689	-0.306	0.213	0.770
13	0.716	-0.296	0.144	0.742
14	0.756	-0.275	0.077	0.740
15	0.719	-0.259	0.221	0.633
16	0.685	-0.292	0.223	0.607
17	0.548	0.270	0.508	0.646
18	*0.458*	0.394	0.526	0.654
19	0.692	0.083	0.372	0.658
20	0.649	-0.004	0.371	0.660
21	0.613	0.086	0.151	0.516
Variance Explained by Each PC	9.833	1.879	1.659	

The results of principal component analysis are: the Eigenvalue for the first PC is 9.833 and it explains 46,8% of all consumer perceived uncertainty. The Eigenvalue for the second PC is 1.879 and these two factors explains 55,8 % of all uncertainty.

In table 2 we are able to see that all uncertainty variables, except variable 18, loaded to the first PC. The variance explained by the first principal component is 9,833 which is very high indeed. All values above 0.50 are acceptable and thus, all variables, except variable 18, are acceptable. All of the communalities are more that 0.6 except one and that still is acceptable and over 0.5. Communalities are very good in value. We decided to drop the variable of 18 away. Thus, we developed the uncertainty point with 20 variables of uncertainty.

5.2 How External Search Determinants Influence Consumer Perceived Uncertainty in Online Purchase

We based our study on Beatty and Smith ´s (1987) model of External search determinants. They base their study on Moore and Lehmann´s (1980) classification of search determinants [4]. The model is comprehensive and there is an extencive literature review behind the model. The original classification is from Bettman [8] and Newman [44]. Beatty and Smith [4] identified the relationship between the antecedent and search as positive (+), negative (-), or no relationship (0) and had listed the nature of the product category.

We conducted linear regression models of each external search determinant to explain the relationship between uncertainty and search determinant. The earlier created general uncertainty point (of 20 variables of PC1) was the dependent variable and the external search determinant variables were the explanatory variables. We used the linear regression analysis because it is a causal model and it gives us explanation for one relationship between external search determinant and the consumer perceived uncertainty. Linear regression analysis also gives us idea of the strengths of the relations. We see the linear regression model suitable for this study.

We found the search determinants that influence most consumer perceived uncertainty are (R^2 >0.40): "1C Difficult to choose a brand" (explains 47% of consumers perceived general uncertainty when purchasing online), "1F Information availability" (explains 58% of perceived general uncertainty), "1H Store distribution" (explains 47% of perceived general uncertainty), "1J Perceived variance in retail operations" (explains 42% of perceived general uncertainty), and "3G Attribute importance" (explains 51% of perceived general uncertainty).

The external search determinants that influence least consumer perceived uncertainty **(R^2 is level 0.001) are** In the group of Market Environmental variables: ("1a Number of alternatives", "1b Number of brands", "1g Number of different stores shopped"). About the Situational Variable of "2f: Store Loyalty" does not have influence on consumer perceived uncertainty, as well as "3H Product Importance/ Involvement" does not have influence on uncertainty. Demographic and individual variables influence least consumer perceived uncertainty: ("5A Education", "5B Income", "5C Location" or "5D Age") and "6B Positive attitude to search", "6C Own ability to search"). The result of the study shows that either "7c Experience", "7D Familiriaty/ usage rate of product /frequency", "7E Expertise /Subjective knowledge", or "7F Objective knowledge to internet shopping" does not have any influence on consumer perceived uncertainty.

Table3: Beatty and Smith´s model of external search determinants relation to uncertainty

External Search Variable	Regression analysis of consumer perceived uncertainty	search	Study
1. MARKET ENVIRONMENT VARIABLES			
1A Number of alternatives	F=0.26, P =0.6080 , R^2= 0.009	+	[16]
1B Number of brands b)	F=0.07, P 0.7875, R^2= 0.002		[33] , [14]
1C Difficult to choose a brand	**F=307.51, P <.0001 R^2= 0.4742**		[59] , [41]
1D Complexity of product	F=46.43, P <.0001 , R^2= 0.1211	+	[15]
1E A lot of alternatives b)	F=17.81, P <.0001, R^2= 0.0503	+	[15]
1F Information availability	**F=463.70, P <.0001 , R^2= 0.5762**	-	[17]
1G The number of different stores shopped NSS b)	F=1.97, P =0.1617 , R^2= 0.0063		[33]
1H Store distribution a)	**F=300.86, P <.0001 , R^2= 0.4687**	+	[43]
1I Product distribution b)	**F=146.40, P <.0001 , R^2= 0.3004**		[56]
1J Perceived variance in retail operations a)	**F=247.95, P <.0001 , R^2= 0.4210**	+	[21]
2. SITUATIONAL VARIABLES			
2A Urgency/Time pressure	F=30.01, P <.0001 , R^2= 0.0824	-	[43] , [4] , [32]
2B Social pressure	F=13.86, P= 0.0002 , R^2= 0.0397		[58]
2C Financial pressure	F=33.61, P <.0001 , R^2= 0.0902	0	[32]
2D Ease of access to information	F=7.34, P 0.0071, R^2= 0.0218	0	[18]
2E Special buying opportunities a)	F=15.90, P <.0001 , R^2= 0.0457	- +	[32] , [58], [14]
2F Store loyalty a)	F=1.18, P=0.2790 , R^2= 0.0035	-	[13] , [14]
3. PRODUCT IMPORTANCE			
3A Price	F=33.61, P <.0001 , R^2= 0.0902	+	[13] , [14] , [32] , [33] , [43] , [57]
3B expectations of obtaining a better price fast seeking more	F=10.40, P =0.0014, R^2= 0.0300	-	[33]
3D Differences among alternatives	F=12.22, P =0.0005, R^2= 0.0354	+	[58] , [55] , [35] ,
3E Perceived price dispersion	F=6.47, P =0.0114, R^2= 0.0191	+	[13] , [58] , [55]
3F Number of crucial alternatives	F=21.87, P <.0001 , R^2= 0.0609	+	[33] , [59]
3G Attribute importance	**F=359.24, P <.0001, R^2=0.5130**	+	[40] ,
4. COST OF SEARCH			
4A Used a lot of time to search/ High cost of search b)	F=20.12, P <.0001 , R^2=0565	-	[47] , [55] , [3], [47] ,
4B Easy to search/ Low cost of search b)	F=7.34, P 0.0071 , R^2=0.0218	+	[55] , [3], [62]
5. DEMOGRAPHICS			
5A Education	F=0.27, P 0.6040 , R^2= 0.0008	+	[32] ,[43] , [15]
5B Income	F=1.30, P =0.2554, R^2= 0.0040	-	[57] , [26]
5C Location of recidence	F=0.67, P =0.4151, R^2= 0.0020		[62]
5D Age	F=0.05, P =0.8313 , R^2= 0.0001	-	[32]
6. INDIVIDUAL DIFFERENCES			
6A Own Ability to judge b)	F=5.27, P0.0224, R^2= 0.165	+	[21] , [59]
6B Positive attitude to search	F=0.84, P=0.3602, R^2= 0.0025	+	[32] , [47] , [33]
6C Own Ability to search b)	F=1.07, P =0.3023 , R^2= 0.0034	+	[59]
7. KNOWLEDGE AND EXPERIENCE			
7A High perceived knowledge	F=41.78, P <.0001 , R^2= 0.1106	+	[33]
7B Usable prior knowledge	F=40.34, P <.0001 , R^2= 0.1061	-	[47]
7C Experience	F=1.60, P =0.2062 , R^2= 0.0048	-	[5],[59] ,[1], [43]
7D Familiriaty/ usage rate of product/ frequency	F=2.23, P=0.1361 , R^2= 0.0066	-	[43]
7E Expertice /Subjective Knowledge	F=0.46, P=0.4971 , R^2= 0.0015		[1], [40] , [33] , [5], [46]
7F Objective knowledge to internet shopping b)	F=2.75, P=0.0982 , R^2= 0.0090		[46]

a)Beatty and Smith´s added variables to original Moorthy and Lehmann´s model
b) Our added variables to Beatty and Smith´s model

Next, we will group the variables of each section together and create a linear regression model of them. Primarily we are interested in finding out if there are any differences between the groups of variables.

Market Environmental variables (1)

$y = \beta 0 + \beta 1 * 1A + \beta 2 * 1B + \beta 3 * 1C + \beta 4 * 1D + \beta 5 * 1E + \beta 6 * 1F + \beta 7 * 1G + \beta 8 * 1H + \beta 9 * 1I + \beta 10 * 1J$

F=142.67, P= <.0001, R^2= 0.8247

Situational Variables (2)

$y = \beta 0 + \beta 1 * 2A + \beta 2 * 2B + \beta 3 * 2C + \beta 4 * 2D$

F=15.42, P = <.0001, R^2= 0.2299

Product importance variables (3)
$y = \beta 0 + \beta 1 * 3A + \beta 2 * 3B + \beta 3 * 3C + \beta 4 * 3D + \beta 5 * 3E + \beta 6 * 3F + \beta 7 * 3G + \beta 8 * 3H$
$F=55.06$, $P<.0001$, $R^2= 0.5472$

Cost of search variables (4)
$y = \beta 0 + \beta 1 * 2A + \beta 2 * 2B$
$F=19.64$, $P<.0001$, $R^2= 0.105$

Demographics variables (5)
$y = \beta 0 + \beta 1 * 5A + \beta 2 * 5B + \beta 3 * 5C + \beta 4 * 5D$
$F=0.48$, $P= 0.7973$, $R^2= 0.0077$

Individual differences variables (6)
$y = \beta 0 + \beta 1 * 6A + \beta 2 * 6B + \beta 3 * 6C$
$F=2.96$, $P =0.0327$, $R^2= 0.0280$

Knowledge and Experience variables (7)
$y = \beta 0 + \beta 1 * 7A + \beta 2 * 7B + \beta 3 * 7C + \beta 4 * 7D + \beta 5 * 7E + \beta 6 * 7F$
$F=11.29$, $P<.0001$, $R^2= 0.1931$

Market Environmental variables explain 82% of consumer perceived pre-purchase uncertainty. Situational Variables explain 23% of consumer perceived pre-purchase uncertainty. Product importance variables explain 55% of consumer perceived pre-purchase uncertainty. Cost of search variables explain 10.5% of consumer perceived pre-purchase uncertainty. Demographical variables explain almost 1 % of consumer perceived pre-purchase uncertainty. Individual difference variables explain 3 % of consumer perceived pre-purchase uncertainty. Knowledge and Experience variables explain 19 % of consumer perceived pre-purchase uncertainty.

7. Conclusions

Beatty and Smith [4] found that consumers search more if the purchase is an expensive, more visible or complex product, and consumers search more for products that include “greater perceived risk”. Secondly, they found that individual factors affect search. Thirdly, they found that factors in the marketplace and buying situation have an effect on pre-purchase consumer information search.

Firstly, we will answer to research question 1: How uncertainty is related to the external search determinants in online purchase?

The external search determinants which have most influence on consumer perceived uncertainty are: ”Information availability”, ”Attribute importance”, ”Difficult to choose a brand”, ”Store distribution”, and ”Perceived variance in retail operations”. If we look at the groups of variables of external search determinants by model of Beatty and Smith [4], we found that most important groups of variables are: Market Environmental variables (which explain 82% of consumer perceived pre-purchase uncertainty) and Product importance variables (which explain 55% of consumer perceived pre-purchase uncertainty).

The external search determinants of Education, Income, Location, Age, positive attitude, one´s own ability to search, Product importance/Involvement, Store Loyalty, and Experience have least influence consumer perceived uncertainty. When we observe the results of the group of external search variables, we are able to see that Demographic and Individual Variables have least influence on consumer perceived uncertainty. It means that highly educated consumers perceive uncertainty in the same way as the low-educated consumers. Not even consumer age, high income or one´s own ability to search has any influence to uncertainty consumers perceive when purchasing online.

Secondly, we will answer to research question 2: What kind of uncertainty consumers perceive when purchasing online? We see connection between the external search determinant of “Information availability” and Knowledge uncertainty (KU) in the Intelligence phase of decision making. (See appendix B). Urbany et al. 1989 defined KU as “uncertainty about knowledge or information about the alternatives”. Further, we see connection between the external search determinant of “3G Attribute importance” and Evaluation uncertainty (EU), because of EU is defined as “Uncertainty about attribute importance and difficulty to compare alternatives”. In the third phase of decision making, we see connection between the variable of “1C Difficult to choose a brand” and Choice uncertainty (CU) (See appendix B). Furthermore, in the last phase of decision making, we see connection between Implementation uncertainty (IU) and the variables of “1H Store distribution”, and “1J Perceived variance in retail operations”. We define IU as “Uncertainty about fulfilment of the delivery” (See appendix B). The phases of decision making theory by Simon (1957) linked to uncertainty dimensions are:

Intelligence phase - Knowledge Uncertainty

Design phase - Evaluation Uncertainty

Choice phase - Choice Uncertainty

Implementation phase - Implementation Uncertainty.

As a conclusion of this study, we are able to see that all consumers perceive uncertainty in all four different decision making phases [53], despite education, income, age or individual differences of consumers. Our test suggest that four dimensions of uncertainty, knowledge uncertainty, evaluation uncertainty, choice uncertainty and implementation uncertainty are the major determinants of total uncertainty related to consumers´ pre-purchase decision process in online markets.

8. Future research and limitations

As decision-making is central to consumer search, it is hoped that uncertainty could be conceptualized further to create a theoretical frame that could be used to analyze consumer search, decision-making and purchasing process in the electronic markets.

Decision making approach is useful to understand consumer online buying behaviour. However, when a purchase is small or otherwise unimportant to the buyer, it does not apply. Similarly, if the purchase is relatively big and important to the buyer it may have some limitations.

Data was collected in a specific context. Our sample consists of 18-65 year Finnish citizens, who are used to advanced technology, who have high education and income. We used a travel context to study uncertainty. It might cause limitations to generalize the results of this study.

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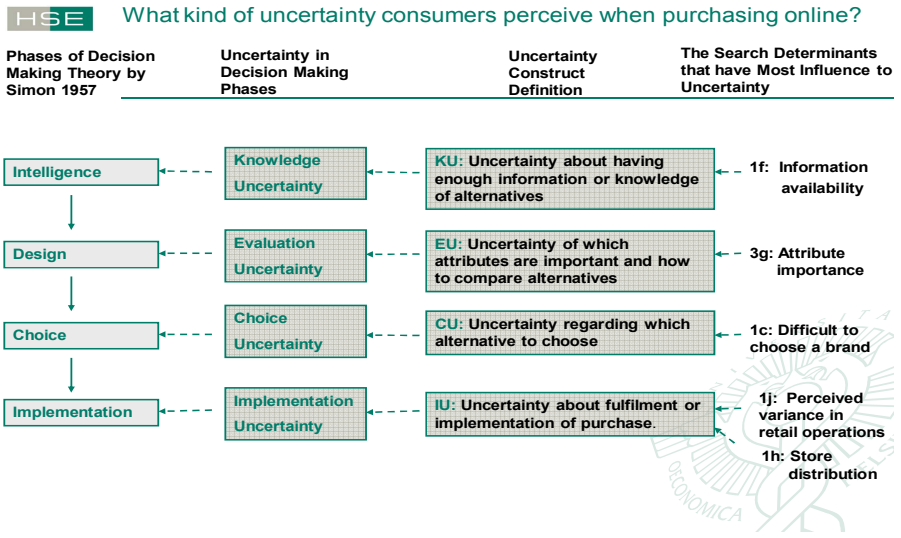
Appendix A: Demographics (*Statistics Finland 2000, **Statistics Finland 2004, ***Statistics Finland 2005)

Gender			**Data**	**Population**
		Frequency	**Percentage**	**Percentage***
Valid	Male	351	54,9	48,8
	Female	253	39,6	51,2
Total		639	100	100
Education			**Data**	**Population**
		Frequency	**Percentage**	**Percentage***
Valid	Comprehensive school education	127	19,87	41,5
	Upper secondary general education	50	7,82	22,9
	Vocational and professional education	159	24,88	12,7
	Polytechnic education	163	25,51	12,6
	University education	96	15,02	10,3
Total		639	100	
Income			**Data**	**Population**
	Euro /Year	**Frequency**	**Percentage**	**Percentage****
	- 3000 - 9999	71	11,11	28,37
	10000 – 24999	147	23	39,09
	25000 – 49999	191	29,89	24,74
	50000 – 80000 -	141	22,07	5.14
Total		639	100	

APPENDIX B: What kind of uncertainty consumers perceive when purchasing online



Impact of Online Pre-Purchase Search on Consumer Satisfaction

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ABSTRACT: Consumers frequently engage in pre-purchase search to extract up-to-date information for their purchase decisions. Search is an essential part of comparison-shopping and decision-making process as it reduces purchase related uncertainty and increases the likelihood of purchase satisfaction. In this paper, we examine the relation of purchase satisfaction and classic determinants of pre-purchase search, measures of purchase related uncertainty, and the type of the search process. We find that only one classic determinant, involvement, influences satisfaction. Instead, we did not find any evidence of the influence of other classic determinants such as product class knowledge, time availability, attitudes toward shopping, and search effort. Moreover, we found that purchase related uncertainties (evaluation uncertainty, choice uncertainty, and implementation uncertainty) and iterative search process are the strongest determinants of satisfaction.

KEYWORDS: comparison shopping, consumer online pre-purchase search behavior, external search determinants, uncertainty, satisfaction, travel purchase, search pattern

1 Introduction

"… and a man comes on the radio
he's tellin' me more and more
about some useless information
supposed to fire my imagination.
I can't get no, oh no no no…"
(M. Jagger/K. Richards)

Consumer search is the main method, besides advertising, for acquiring information necessary to purchase decisions. Consumers look for products with desired qualities and sellers offering these products at competitive prices in an attempt to decide what, when, and from whom to purchase. Identification of prospective products and sellers is a primary source of uncertainty. Search is needed also because sellers and buyers enter and leave the markets, new products are introduced, and prices fluctuate as production costs vary (Stigler 1961). Another, yet related, cause is consumers' inability to ascertain product quality and seller reliability before the purchase decision; it may take a lengthy period of use to determine the quality. Information search is costly, which prohibits consumers from obtaining extensive market knowledge, resulting in price dispersion in most consumer markets. Absence of search costs would, in theory at least, enable consumers to make consistently well informed purchase decisions, and thus improve market efficiency.

Electronic markets benefit from increasing productivity of information technology, since product information can be disseminated at increased speed, quantity, and quality (Malone, Yates et al. 1989). Enhanced exchange of information is commonly believed to mollify information related market imperfections by allowing consumers to update their market knowledge more extensively than what is feasible in most conventional consumer markets (Bakos 1997). While increasing performance/price ratio of information and telecommunication technology is a fact, it is less clear if improvement in data transmission alone will substantially enhance the markets by driving down search costs. Empirical evidence seems to point to the contrary (Brynjolfsson and Smith 2000; Öörni 2003). Low cost of data transmission guarantees that information can be amassed in great quantities, yet, it simultaneously raises the problem of sifting information. Information search is further complicated by the difficulty of validating information and these complications are expected to continue to exist in electronic consumer markets (see e.g. Whinston, Stahl et al. 1997).

It seems evident that the future development of electronic consumer markets crucially hinges on development of more advanced shopping aids that will enable consumers not only retrieve and sift product information but also help assess this information, judge products and sellers, and even evaluate their purchase related preferences. This all amounts to the development of electronic shopping aids being guided by the needs of the consumer. While the previous statement may seem obvious even to a casual spectator, realization of consumer oriented technology continues to be a challenge for our understanding of consumer behavior remains far from perfect despite the substantial progress that has been made over the past few decades. The complexity of consumer decision phenomenon is depicted by the notion that more than 60 determinants have been related to the amount of pre-purchase consumer search (Schmidt and Spreng 1996) alone. Yet, we still regularly fall short of being able to attribute purchase related satisfaction to its constituents.

In this paper, we aim to advance development of electronic shopping aids by identifying the most important factors influencing the outcome of search in electronic consumer markets. A number of contingency factors of search have been found to affect external search effort (see e.g. Bettman 1979) and these factors manifestly interact (Punj and Staelin 1983; Beatty and Smith 1987). According to consumer behavior literature, the combination of information sources used to search is likely to be contingent, at least, on individual characteristics, product class, and the environment of search (Bettman, Johnson et al. 1990). This trinity of influences seems to dominate consumer search literature in various combinations and conceptualizations. Our analyses suggest that we can reduce the determinants of purchase related satisfaction into the following set of factors: prior uncertainty, product class involvement, and type of the search process.

2 Theory

Consumer satisfaction has emerged as one of the central concepts of consumer centric business for it has been related to desired outcomes in consumer relations, such as brand loyalty (Bloemer and Kasper 1995), repurchase intentions (He, Chan et al. 2008; Leingpibul, Thomas et al. 2009), recommending (Paul and Robin 2004), and complaining (Jeanne, Maureen et al. 2001; Richard and Anand 2001). As a result, consumer satisfaction is seen as a worthwhile interim goal in the pursuit of profitable retail business. While the definitions of consumer satisfaction are varied, they all agree that satisfaction is a response (emotional or cognitive) pertaining to a particular focus determined at a particular time (Giese 2000). For the purposes of the current study, we define consumer satisfaction as a purchase self-evaluation of the purchase.

Consumer satisfaction has been theoretically connected to cost savings and amount of external information search as its antecedents (Punj and Staelin 1983). The varied measures of search effort (Newman 1977; Punj and Staelin 1983; Srinivasan and Ratchford 1991; Bettman, Luce et al. 1998) substantially complicates identification of the primary antecedents of satisfaction among the large number of factors related to external search (see Schmidt and Spreng 1996). We elect to concentrate on those measures which have a clear theoretical relation to the dependent measure of interest, purchase satisfaction.

We have identified the works of Punj and Staelin (1983) and Beatty and Smith (1987) as a fruitful starting point. The former related amount of search and its antecedents to purchase related satisfaction while the latter refined the determining variables into a set of four constructs: 1) product class knowledge, 2) time availability, 3) purchase involvement, and 4) attitudes towards shopping. As past research has acknowledged that amount of search does not completely subsume their effect on search, we elect to include the amount of search in the set of independent variables. The economics of information stream of research adds two determinants to our set of determinants, uncertainty (Stigler 1961) and type of the search process (see, e.g. Whinston, Stahl et al. 1997, pp. 265-6), both of which have been related to the quality of the purchase decision. We will next discuss the constructs of Beatty and Smith in more depth followed by discussions of purchase related uncertainty and type of search process.

2.1 Product Class Knowledge

Punj and Staelin (1983, p. 368) distinguished between organization of product information and actual product attributes. They included in the concept of Prior Memory Structure “the consumer’s knowledge of the buying process as well as knowledge associated with [the product category] in general”. The concept has since been adopted under the labels of Product Class Knowledge (Brucks 1985) and Product Category Knowledge (PCK) (Fiske, Luebbehusen et al. 1994). Studies focusing on PCK have usually identified positive association between knowledge and the magnitude of search effort (Brucks 1985). Usable Prior Knowledge (Punj and Staelin 1983, p. 368), on the other hand, refers to the actual, detailed information accumulated. The concept has since received multiple labels, yet, the one that seems to enjoy the most widespread acceptance is Brand Knowledge (BK) (e.g. Brucks 1985; Fiske, Luebbehusen et al. 1994). Brand knowledge has often been found to limit search through a de-motivating effect: The more consumers have accumulated detailed product information, the less benefit they perceive in search.

Brand knowledge and product category knowledge show signs of being related as they tend to develop in tandem (Fiske, Luebbehusen et al. 1994). They do not, however, seem to share all of their antecedents: “Specific product-class information is gained by using the product in everyday activities, while directly relevant purchase-task information is obtained each time a person goes through the task of buying … .” (Punj and Staelin 1983) Hence, the two types of knowledge are usually seen conceptually distinct types, the PCK capturing the evaluative dimension and BK the actual product details. This distinction can also be found in Urbany’s (1986) characterization of abstract (i.e. product category related) and concrete product related knowledge. Fiske et al. (1994) suggest two reasons to distinguish between BK and PCK. “First, the two constructs may have different effects on search behavior. Second, while BK and PCK likely develop in tandem over time, there are many situations in which existing PCK is relevant to a search problem, yet BK is not (e.g., when a consumer moves to a new market or several new brands have been introduced since the last purchase).”

H1: High product class knowledge has a positive effect on purchase satisfaction.

2.2 Time availability

Empirical evidence indicates that consumers reach relatively quickly the point where the perceived cost of search is higher than the expected benefits. Consumers rarely visit more than one or two shops even when buying high-ticket consumer durables (e.g. Newman and Staelin 1972; Wilkie and Dickson 1985). Crowell and Bowers (1977) have shown that, in particular, the cost of a consumer's time determines to a great extent how much search is feasible. The value of time is a controversial topic. Clearly, the opportunity cost of time varies from consumer to consumer. Furthermore, Leclerc et al. (1995) have shown that the value of a consumer's time is not constant but depends on contextual factors.

Time constraints profoundly affect the difficulty of the decision. Increased time constraints have been found to lead the decision-maker to simplify the task at hand (Wright 1974), to accelerate the information processing (Ben Zur and Breznitz 1981), to selectively focus on information (Miller 1960), and to change the decision strategy employed (Payne, Bettman et al. 1988). Likewise, an increase in the number of alternatives may lead consumers to simplify their information processing.

H2: High time constraints are related to purchase dissatisfaction.

2.3 Purchase involvement

Schmidt and Spreng (1996) suggest that involvement (Krugman 1965) influences motivation to search. The degree of personal involvement has also been found a key factor in shaping the type of decision process that consumers will follow (Blackwell, Miniard et al. 2001, p. 91). Antil (1994) defines involvement as the "level of perceived personal importance and/or interest evoked by a stimulus within a specific situation". Consumer behavior literature identifies three sets of factors influencing purchase involvement: 1) personal factors, 2) product factors, and 3) situational factors (Blackwell, Miniard et al. 2001, p. 91). Personal factors are relatively enduring and include self-image, looks, and health, among others. Product factors are largely related to risks in purchasing or using the product: risk of misinvestment, or risk of bodily harm. Situational factors are related to mode of consumption: whether the product is bought as a gift, whether the product is bought for personal consumption or to be consumed in company of others, such as a vacation.

H3: High levels of involvement are related to high levels of purchase satisfaction.

2.4 Attitudes toward shopping

Beatty and Smith (1987) theorized that attitudes towards shopping, a construct closely related to purchase involvement but directed towards the process of purchasing rather than the product class, are strong candidates for determining the amount of search. They based their view on previous findings about the strong positive relationship between attitudes towards pre-purchase search and actual search behavior (Kiel and Layton 1981; Duncan and Olshavsky 1982; Punj and Staelin 1983). Of particular interest are the observations of Duncan and Olshavsky (Duncan and Olshavsky 1982), which demonstrate a strong relationship between attitudes toward shopping and regret avoidance: "when important purchase are made quickly, they are usually regretted".

More recent research has also highlighted the impact of attitudes towards toward shopping on the search effort: Schmidt and Spreng (1996), for example, propose that motivation to search is affected by shopping enthusiasm (Babin, Darden et al. 1994). Several studies have also demonstrated that consumers' attitudes toward shopping continue to influence their behavior in the electronic markets as well (Fiore, Jin et al. 2005; Mummalaneni 2005). A typical finding is that consumers who find Internet shopping pleasant search for more information. Hence, positive attitude should, in theory at least, lead to better purchase decisions.

H4: Positive attitude towards Internet shopping is related to purchase satisfaction.

2.5 Search effort

The economics of information theory is based on the premise that buyers do not fully inform themselves about the alternatives available in the markets because of high search costs (Stigler 1961; Ratchford 1982). The theory implies that both the benefits and the costs of search are related to the number of alternatives considered. Thus, it is more likely that good alternatives are included in the subset of products considered as the size of the consideration

set increases. The economics of information theory further implies that, in terms of benefits of search, the returns are sharply diminishing. Every additional alternative examined offers a smaller potential increase in benefits than the previous ones. The cost of searching for an additional alternative tends to increase. As it takes progressively more effort to locate new offerings, a point is reached at which the expected cost of considering an additional alternative exceeds the potential increase in benefits. Empirical evidence indicates that consumers relatively quickly reach the point where the perceived cost of search is higher than the expected benefits. Consumers rarely visit more than one or two shops even when buying high-ticket consumer durables (Newman and Staelin 1972; Wilkie and Dickson 1985).

Alba et al. (1997), while discussing the merits of interactive home shopping (IHS), posit that the vast number of alternatives available to consumers is a significant benefit of IHS compared with other retail formats. Bakos (1997) suggests that declining search costs in the electronic markets will enable consumers to engage in more extensive pre-purchase search. Thus, consumers should be able to extend their pre-purchase information search, yet it is not clear which dimensions of the search effort will be affected most. Literature on electronic market efficiency proposes that consumers will visit a higher number of retailers (Bakos 1991b; Bakos 1997; Bakos 1998). This hypothesis is based on the assumption that products are either homogeneous or the consumer has an existing preference structure for the decision and has already narrowed search down to a few brands and, thus, focus on price comparison.

In reality, it is easy to observe that most consumer products are heterogeneous – even if they differ only by brand. Furthermore, it is argued that consumer choice is inherently constructive. Due to limited processing capacity, consumers often do not have well-defined existing preferences; the preference structure is instead constructed during the search process using a variety of strategies contingent on task demands (Bettman, Luce et al. 1998). Thus, the number of sellers appears to be an insufficient measure for the search effort and more measurement dimensions are warranted. In consumer search literature, a number of gauges have been suggested for the measurement of the extent of search. These measures include, besides time spent in the process, number of retail stores visited, and number of alternatives considered (Newman 1977; Punj and Staelin 1983; Srinivasan and Ratchford 1991; Bettman, Luce et al. 1998).

H5: The search effort, measured by the number of sellers visited, and number of alternatives considered is related to purchase satisfaction.

2.6 Uncertainty

Uncertainty is one of the central concepts in consumer behavior literature. It captures the lack of the individual's control over how future is going to unfold. Future events are difficult to foresee mostly because consumer environments are both complex and in constant change. Changing identity of sellers and buyers, and fluctuation in supply and demand result in uncertainty since information becomes obsolete (Stigler 1961). Consumers must therefore update their information, and there is often no better means to do that than search. Accordingly, Lanzetta (1963) posited that higher levels of uncertainty should lead to more extensive search, and search activity has been observed to increase with uncertainty (Lanzetta and Driscoll 1968). What is more, consumers typically can't know or predict accurately the amount of knowledge they already have. It has been demonstrated that people are sensitive to uncertainty even if their ability to substantiate this uncertainty is often quite limited (Lichtenstein and Fischhoff 1977). What is more, uncertainty may encourage as well as discourage problem solving as both complete certainty and complete uncertainty are likely to inhibit action (Dewey 1910, p. 9, 112).

The position that uncertainty and search are related has received considerable empirical support: several constructs indicative of uncertainty (e.g. low prior knowledge, unfamiliarity, inexperience) have been found to relate to search (for an extensive review, see e.g. Fiske, Luebbehusen et al. 1994). What heightens the importance of uncertainty as a predictor is the failure of many other, theoretically sound concepts to determine consumer search. Yet, despite its prevalence in consumer behavior theories, uncertainty the concept remains surprisingly vague. Few efforts have been made to address its composition, Urbany et al. (1989) and Moorthy et al. (1997) being among the notable exceptions. We extend the work of Urbany et al. (1989), who identified two dimensions of uncertainty, knowledge uncertainty and choice uncertainty, as possible determining factors of consumer pre-purchase search.

Urbany et al. (1989) suggested that uncertainty is a multidimensional construct, and its effect on consumer search may be conditional to the dominant form of uncertainty present in the purchase decision. The authors distinguished two types of uncertainty, labeled knowledge uncertainty (KU) and choice uncertainty (CU). Knowledge uncertainty captures doubts consumers have about their own ability to judge sellers and products well enough to execute reasonable product comparisons, whereas choice uncertainty arises from the conflict about which

alternative to choose (Urbany 1986; Urbany, Dickson et al. 1989). While the former construct is likened to the original idea of uncertainty put forth by Stigler (1961), the latter is reminiscent of "response uncertainty" coined by Lanzetta (1963), who, referring to Berlyne (1960), stated that uncertainty occurs when the "choice of the best alternative is equivocal" in the context of resolving a conflict. Urbany et al. (1989) acknowledged that their uncertainty constructs were highly correlated, which they interpreted suggesting the presence of yet another dimension of uncertainty, labeled evaluation uncertainty (EU). Theoretical support for such a proposition can be found in decision making literature in which uncertainty has been tagged as an antecedent of judgment (Dewey 1910, p. 9, 102).

Both Dewey and later decision making theorists have usually identified four steps in the decision process. While John Dewey (1910) introduced the notion of decision making as a sequence of decomposed stages that converge on a solution, Herbert Simon (see e.g. 1960, p. 2) established the dominant model of the decision-making process as a three phase "intelligence-design-choice" sequence (Langley, Mintzberg et al. 1995), which was later supplemented with a fourth stage of "implementation" as many authors felt it significant enough to be shown separately (see e.g. Sprague Jr. and Carlson 1982, pp. 26-27). As the previously discussed uncertainties cover only the first three steps of decision making, we propose that a fourth type of uncertainty, implementation uncertainty (IU), should be added to the host of pre-purchase uncertainties. We expect that the search effort will subsume some of the influence of uncertainty as suggested by Urbany et al. (1989), yet, any residual uncertainty will likely have negative impact on purchase satisfaction.

H6: Pre-purchase uncertainties (Knowledge Uncertainty, Choice Uncertainty, Evaluation Uncertainty, and Implementation Uncertainty) are related to purchase dissatisfaction.

2.7 Search process

Uncertainty amplifies need for information processing capacity, which is finite. According to Herbert Simon decision making is often hampered significantly by the limited human cognitive ability: "The capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problems whose solution is required for objectively rational behavior in the real world." (Simon 1957, p. 198) Thus, not only objectively rational problem solving but also problem formulation is often beyond human cognitive capabilities. Building on bounded rationality, championed by Simon (1955; 1957), Bettman et al. (1998) have proposed that, "due to limited processing capacity, consumers often do not have well-defined existing preferences, but construct them using a variety of strategies contingent on task demands." In this context, the search process is not characterized by evaluation of products against an existing set of decision criteria. Rather, search is necessary for the consumer to be able to identify the procurement criteria and their relative importance.

Experienced and inexperienced consumers often resort to different types of search patterns. While experienced consumers utilize largely the information already in their long-term memory, inexperienced consumers have to retrieve this information from the environment. The former search pattern is often depicted as simultaneous search (see figure 1 in essay 2), consisting of a single information retrieval phase followed by the decision. Sequential search, on the other hand, often comprises multiple consecutive information retrieval and decision phases, each of which contributes to the total search cost. Whinston et al. (1997, p. 267) suggest that online search technology may automate the search process and enable consumers to execute more sophisticated and efficient searches. It holds the promise of shifting search increasingly from the domain of sequential search towards simultaneous search. There are, however, prerequisites related to consumer preferences that have to be satisfied before such transformation is possible. In particular, consumers should have stable preference structures to be able to accurately model the decision problem at hand. As pure simultaneous search is rather demanding on the consumer's cognitive capabilities, combinations of sequential and simultaneous searches are likely to prevail. We term such search processes iterative. Theoretically, pure simultaneous search should be the most efficient search process and sequential search the least efficient. However, simultaneous search tends to require more expertise than the average consumer has. We believe that iterative search combines realistically the best combination of cognitive effort and efficiency:

H7: Iterative search is related to purchase satisfaction.

3 Data and Analysis

3.1 Survey Data

A questionnaire was sent to the random sample of size 2000 representing the Finnish population (over 18-year old). The questionnaire was pre-tested with two groups: experts and consumers from different age and demographics. The pre-test was carried out with 27 subjects. The questionnaire was revised accordingly.

The questionnaire was returned by 639 respondents. Thus, the response rate was 32 %. To study how well our final sample represents the Finnish population, we compared demographic variables of the sample to the corresponding variables in the latest census figures (from year 2004) for the Finnish population. The results are given in Table 4.

Our sample consists of more males (58.1%) and less females (41.9 %) than in the population. Because the questions concerning the use of internet had a dominant role in questionnaire, a plausible explanation is that males are known to use more internet than females. More educated people have been more active to respond to our questionnaire as well as the people with high income. We conclude that our sample represents the population of Finnish people familiar with internet accurately enough for our purposes.

Table 4: Comparing Demographic Variables in the Sample and the Finnish Population

		Frequency	Sample Percentage	Population Percentage*
Gender				
Valid	Male	351	58.1	48.8
	Female	253	41.9	51.2
Total **		604		
Education				
Valid	Comprehensive school education	127	21.3	41.5
	Upper secondary general education	50	8.4	22.9
	Vocational and professional education	159	26.7	12.7
	Polytechnic education	163	27.4	12.6
	University education	96	16.1	10.3
Total		595		
Income	Euro /Year			
	3000 – 9999	71	12.9	28.4
	10000 – 24999	147	26.7	39.1
	25000 – 49999	191	34.7	24.7
	50000 – 80000	141	25.6	5.1
Total		550		*** 97.3

* Statistics Finland (2004)

** The total number of observations (639) differs from "Total" in the Table

*** The salary range in the sample covers no whole salary range in the population

Because we were interested in the consumers who had some experience on internet use and have made at least one over-night journey within past five years, we extracted a sub-sample of size 359 from the sample for further research questions.

3.2 Method

Our purpose is to find the determinants explaining the post-consumption satisfaction of online travel purchase. Satisfaction is measured by two variables: satisfied with the price of the purchase and satisfied with the quality of the purchase. Both variables were evaluated by the subjects on a 1-7 scale. The frequency distribution of the variables was very skew, because most subjects were very satisfied with their purchase (Quality and Price). That's why we re-coded the variables in such a way that the class consisting of values 6 and 7 was called "Satisfied with Quality (Price)" and the class with values 1-4 was called "Dissatisfied with Quality (Price)". Thus we have four classes.

SATISFIED WITH QUALITY, BUT NOT PRICE n=33	**SATISFIED WITH BOTH n= 260**
DISSATISFIED WITH BOTH n=33	**SATISFIED WITH PRICE, BUT NOT QUALITY n=33**

Figure 3: The Satisfaction Classes

The first group, *Dissatisfied with Both (n=33)* consists of those subjects, who were not satisfied with neither the quality nor the price of the purchase. They have bought a journey, which was not suitable for them at all. The second group *(n=33)* consists of the subjects, who were *"Satisfied with the Price, but not Quality"*. The third group *(n=33)*, includes respondents who were *"Satisfied with the Quality, but not Price"*. The subjects *"Dissatisfied with Both"* were classified to the fourth group *(n=260)*.

Our aim is to study which of our research hypotheses H1-7 are supported by our survey data. There are one or several underlying quantitative variables behind each hypothesis (see, Appendix). The total number of variables is 17 (Table 5). A problem is to find the most essential variables from among those 17 variables having influence on the satisfaction of the purchase (quality and price). When those variables are found, we may conclude which of the research hypotheses are supported. As a method we use the univariate and multivariate analysis of variance.

4 Findings

4.1 Multivariate Test for Potential Independent Variables

First, we check whether those 17 variables together consists of significant discriminating information on the differences of four group means. For this purpose, we use Wilks' lambda as a test statistic to test the multivariate hypothesis:

$$H_0: \mu_1 = \ldots = \mu_4 \text{ given } \Sigma_1 = \ldots = \Sigma_4, \quad (1)$$

where vector μ_i, i = 1,2,3,4, refers to the population group means in the 17 dimensional space, and Σ_i, i = 1,2,3,4 refers to the covariance matrix of group i. Wilks' lambda computed from the sample is 0.6961. If there are no significant differences between group means, $\Lambda \sim 1$. Note that always $\Lambda \leq 1$. To study, whether $\Lambda \sim 1$, we use the F-approximation (see, e.g. Rao (1973, p. 556)). From the sample we get F-value = 2.56 > F(0.01, 51, 1010) = 1.54. Thus we conclude that $\Lambda < 1$, and further $\mu_i \neq \mu_j$ for some $i \neq j$ at risk level less than 1%.

4.2 Univariate F-Tests for Potential Independent Variables

In Table 5, we have carried out the univariate F-tests for each variable. The results provide us with some hints that not all 17 variables are needed to provide essential discriminating information.

Table 5: Univariate F-Statistic

Variable	Total Standard Deviation	Pooled Standard Deviation	Between Standard Deviation	F Value	P{F(3,355) > F-Value}
Product Class Knowledge (PCK)	2.342	2.342	0.243	0.970	0.408
Time Constraints (TC)	1.950	1.947	0.239	1.350	0.258
Involvement: Importance (INV_I)	1.946	1.912	0.463	5.260	0.002
Involvement: Price (INV_P)	1.972	1.901	0.638	10.100	<.0001
Attitude: I	1.611	1.611	0.164	0.930	0.424
Attitude: II	1.603	1.600	0.203	1.450	0.228
Attitude: III	1.705	1.704	0.191	1.130	0.339
Search Amount: Sellers (SA_S)	1.324	1.324	0.143	1.050	0.373
Search Amount: Alternatives (SA_A)	4.033	4.042	0.291	0.470	0.706
Search Amount: Time (SA_T)	5.326	5.344	0.243	0.190	0.906
Search Process: Sequential (SP_S)	0.492	0.489	0.083	2.580	0.054
Search Process: Parallel (SP_P)	0.388	0.389	0.018	0.200	0.898
Search Process: Iterative (SP_I)	0.491	0.486	0.095	3.440	0.017
Knowledge Uncertainty (KU)	1.613	1.612	0.184	1.160	0.323
Evaluation Uncertainty (EU)	1.184	1.151	0.339	7.790	<.0001
Choice Uncertainty (CU)	1.262	1.219	0.400	9.670	<.0001
Implementation Uncertainty (IU)	1.495	1.452	0.439	8.210	<.0001

4.3 Selection of Relevant Independent Variables

For further analysis, we initially pick from Table 5 the variables for which F-Value > F(0.05, 3,355) = 2.63 (risk level $\alpha = 5\%$). Those variables are *Involvement: Importance* (INV_I), *Involvement: Price* (INV_P), *Search Process: Iterative* (SP_I), *Evaluation Uncertainty* (EU), *Choice Uncertainty* (CU), and *Implementation Uncertainty* (IU). To carry out the null hypothesis H_0 with these variables, we obtain $\Lambda = 0.755 \sim \Lambda(6, 355, 3)$, for which F-Value = 5.75 > F(0.01, 33,1017) = 1.95, and we conclude H_1: $\mu_i \neq \mu_j$ for some $i \neq j$.

To check, whether we can drop the remaining 11 variables from further analysis, we test the null hypothesis H_0 with the remaining 11 variables. We get $\Lambda = 0.901 \sim \Lambda(11, 355, 3)$, for which F-Value = 1.11 < F(0.01, 33,1017) = 1.68, and we conclude H_0. Thus there is no evidence that those remaining 11 variables include any essential discriminating information about the differences between the satisfaction classes. It means that variables INV_I, INV_P, SP_I, EU, CU, and IU sufficiently describe the mean differences in the classes.

Table 6: The Satisfaction Group Means of Variables Essentially Contributing to Discrimination

Variable	Dissatisfied with both (n=33)	Satisfied with price, not quality (n=33)	Satisfied with quality, not price (n=33)	Satisfied with both (n=260)	Total (n=359)
Involvement: Importance (INV_I) (1-7)	4.51	4.09	5.5	5.26	5.11
Involvement: Price (INV_P) (1-7)	4.36	3.33	5	3.29	3.55
Search Process: Iterative (SP_I) (0-1)	0.24	0.27	0.58	0.42	0.4
Evaluation Uncertainty (EU) (1-7)	2.79	2.48	1.94	1.89	2.03
Choice Uncertainty (CU) (1-7)	2.9	2.76	2.33	1.95	2.14
Implementation Uncertainty (IU) (1-7)	3.15	1.97	2.51	1.91	2.09

Based on the group means in Table 6, the influence of the variables on satisfaction can be characterized as follows:

Involvement: Importance. Involvement influenced purchase satisfaction as predicted: the high-involvement consumers were more satisfied than the low-involvement consumers with the travel they purchased. When consumers feel more attached to the product, they are motivated to ensure that the purchase will meet their wants. They are likely to search both more extensively and more intensively. Since involvement was clearly related to purchase satisfaction even though search effort was not, we deduce that involvement operated through intensity of search in our data.

Involvement: Price. High price relative to one's income influenced purchase satisfaction yet the form of influence was contrary to what was predicted. For the *"Satisfied with quality, not price"* group this is can be explained by normal price-quality correlation: high quality travels tend to be relatively more expensive. The *"Dissatisfied with both"* group, however, exhibits market failure. These consumers evidently badly misjudged the travel they bought. While the price-search effort relationship is theoretically strong (Stigler 1961), it has received irregular empirical support. Neither absolute nor relative price of the product have been consistently found to determine the effort put into search or the outcome of search (Schmidt and Spreng 1996). Our data suggest that while price relative to one's income may not consistently determine the search effort, it is far from being unimportant as a determinant of consumer behavior. Taken together, the involvement hypothesis (H3) received partial support: High involvement leads to satisfaction, with qualifications.

Search Process: Iterative. The search process hypothesis (H7) was supported: Iterative search was the only search process type that influenced purchase satisfaction. Iterative search process combines stages of sequential and simultaneous search. The sequential steps are often needed and used for construction of the problem rather than for solving it. Our observation is in line with the relatively recent view of pre-purchase search being a mainly learning process in which the consumer gets educated about his/her preferences (Bettman, Luce et al. 1998).

Evaluation Uncertainty. Evaluation uncertainty influenced purchase satisfaction as predicted. High pre-purchase evaluation uncertainty affected purchase satisfaction. Evaluation uncertainty comprises doubts about one's ability to evaluate products. It is connected to incomplete product class knowledge, indecision about the product qualities that determine the eventual performance of the product. In the current context, doubts about the influence of the hotel's location on the travel experience serve as an example of evaluation uncertainty.

Choice Uncertainty. Choice uncertainty influenced purchase satisfaction as predicted. High pre-purchase choice uncertainty affected purchase satisfaction. Uncertain consumers are unsure about the ranking of the choice alternatives. One prominent reason for choice uncertainty is incomparable choice alternatives. If the alternatives do not share their salient characteristics there is no obvious ranking for them even if the preferences are known. It is doubtful if choice uncertainties can be effectively cured unless the industry agreed on a comprehensive ontology of product description on which the shopping aids can be built on.

Implementation Uncertainty. Implementation uncertainty influenced purchase satisfaction with qualifications. Its impact was most pronounced for the *"Dissatisfied with both"* group. It was second highest in the *"Satisfied with quality, not price"* group: It seems probable that these consumers "bought" themselves some assurance. Taken together, the uncertainty measures support the uncertainty hypothesis (H6) with a qualification: Knowledge

uncertainty did not influence purchase satisfaction. We interpret this as a sign of electronic markets providing sufficient product attribute information.

5 Discussion

Taken together, our analysis provide support for the hypotheses H3 (involvement), H6 (uncertainty), and H7 (iterative search). Our observations suggest that of the classic determinants of the search effort studies only purchase involvement was related to purchase satisfaction. Those consumers who found the product personally more important were likelier to do good job with searching for and choosing a pleasing product. It is also interesting to note that neither unvariate nor multivariate tests have provided us any evidence for the variables excluded from the final analysis containing any information towards explaining purchase satisfaction.

The observation about iterative search process being related to purchase satisfaction with the product is in line with observations about the effects of pre-purchase uncertainties. While iterative search is, at least in theory, less efficient than purely simultaneous search, it has the advantage of "educating" consumers about their preferences. This is close to the approach of Keeney and Raiffa (1976, p. vii) who advocate for decision analysis, "a prescriptive approach designed for normally intelligent people who want to think hard and systematically about some important real problems."

Our observations suggest that uncertainty felt prior to the purchase process still remains a strong determinant of purchase satisfaction. Uncertainties related to evaluating and choosing products, in particular, affected the experienced satisfaction. We interpret this finding to suggest that those consumers who were uncertain about their preferences before the purchase process remained relatively ill informed up to and past the purchase decision, which resulted in purchase dissatisfaction. Thus, despite all the progress we have made so far, further research in developing decision aids for the consumers is in need.

The exception to the rule is knowledge uncertainty. Apparently the current electronic markets have advanced past the stage where access to product information has ceased to be a problem. Taken together, the pattern of uncertainty influences on consumer satisfaction suggests that the amount of product information available to consumers exceeds the processing capacity rather than falls short of providing an adequate basis for informed purchase decision. Thus, need for effective tools of evaluation, such as recommendation aids or intelligent agents, appears to be in the rise.

6 Conclusions

Consumers that are satisfied with quality of travel used most often iterative search. It seems that iterative search process leads consumers to satisfied purchase. With Iterative search process i.e. "Search with recall" consumers are able to search long enough to be sure they have found the best alternative. This means that we should develop the search agents to help consumers do iterations while searching information from different sources. Nowadays most search agents are made to compare price, but not quality of products. Still, it seems that the quality of product is most important characteristic for consumers when they estimate their satisfaction on purchase.

We are able to summary this studies result: consumer perceived satisfaction of travel online purchase relate more to uncertainty than the external search determinants. One explanation is: It may be more important for a consumer to feel that he knows what he is doing than to know that he is making the most optimal choice.

7 References

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8 Appendix: Survey Questions Relevant to the Study

PRODUCT CLASS KNOWLEDGE
(7 step school grade scale ranging from 4 to 10)
Please, estimate your ability to search for and compare travel services.

SEARCH EFFORT
How many brick-and-mortar travel outlets did you visit? (number)
How many Internet travel outlets did you visit? (number)
How many alternatives did you consider? (number)
How much time did you spend to the whole purchase process (search, comparison, and purchase)? (hours)

UNCERTAINTY
(1 = totally uncertain … 7 = totally certain)
Thinking back to the start of the latest purchase process,
how certain were you about knowing the travel services offered,
how certain were you about your purchase criteria,
how certain were you about which alternative to choose,
how certain were your that you would be able to buy the alternative you had chosen?

INVOLVEMENT
(1 = totally disagree … 7 = totally agree)
Buying this travel was an important purchase for me.

TYPE OF SEARCH PROCESS
(mutually exclusive dichotomies)
Which one of the following statements best describes your method of finding the travel?
I searched for and evaluated each travel, one at a time, before turning to the next alternative.
I used search agent or comparison shopping tool for searching for alternative travels.
I iterated the purchase process when searching for and comparing alternatives.

SATISFACTION
(1 = totally disagree … 7 = totally agree)
I was satisfied with the quality of my chosen travel.
I was satisfied with the price of my chosen travel.

ATTITUDE TOWARDS SHOPPING ONLINE
(1 = totally disagree … 7 = totally agree)
It is a good idea to search travel information in the internet.
It is rational to search travel information in the internet.
I like to search travel information in the internet.

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