

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

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	Task 2	Task 3
	High KU	Low Uncertainty	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.

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

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
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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 Search pattern	Uncertainty		
	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 Search pattern	Uncertainty		
	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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