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When Recommendation Agents Influence Decisions

The Power of Recommendation Sets

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When Recommendation Agents Influence Decisions: The Power of Recommendation Sets

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ABSTRACT

Today, most online vendors provide assistance of a Recommendation Agent (RA) to help consumers to process information and make product decisions. When consumers tend to rely on these RAs in their decision process, they open a potential gateway to influence and manipulation. Many papers are dedicated to the subject of RAs. However, these studies are either mainly focused on the underlying algorithms of RAs or they are especially focused on the usefulness of RAs to consumers and in what way consumers respond to these systems. The objective of the current study was to examine the effects different recommendation sets have on consumer decision making in an online environment with the use of a RA. The results of this study indicate that the use of different recommendation sets has a substantial impact on consumers' product choice, decision effort, decision quality, satisfaction, and choice deferral. These findings suggest that consumers' choice preferences indeed can be influenced in a systematic manner by altering the set of recommendations and the context in which these alternatives are presented.

Keywords: Online Environment; Online Shopping; Consumer Decision-Making; Consumer Behaviour; Recommendation Agents; Recommendation Sets

The Internet is the world's largest shop. It's just that all the products are on the floor.

Rob Peeters, variation of a quote by John Allen Paulos

Getting information off the Internet is like taking a drink from a fire hydrant.

Mitch Kapor, variation of a quote by Jerome Weisner

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1. INTRODUCTION

Today, it is hard to imagine a life without e-commerce. More and more people and companies are embracing it. If we examine the Dutch market for example, we see an increase of Dutch consumers who shop online. In 2009, nearly three-quarters of the 11.8 million Internet users in the Netherlands said they had purchased a product online. Just over two-thirds of them are frequent online shoppers, and had bought a product online in the three months preceding the survey. This is more than half of Internet users. In 2002, only two out of ten Internet users were frequent online shoppers[1]. We also see an increase in sales of products and services. In 2004, Dutch companies noted that ten percent of their revenue came from online sales in contrast with the four percent in 2000[2]. For the vast amount these sales take place in online vendors where consumers can search for product information and purchase products. Yet, to find a product in the online environment[3] that meets a consumers' specific needs or preference is not an easy task. Many consumers feel like being overrun by information. The reason for this is that most online vendors offer a large amount of product alternatives and also vast amount of information about product offerings is available. Today, most online vendors provide assistance of a Recommendation Agent[4] (RA) to help consumers to process information and make product decisions. The tendency of consumers to rely to some extent on these RAs in their decision process may influence the way consumers gather product information and make purchase decisions accordingly.

This study investigates the effects that these RAs may have on consumer decision-making in the online environment when recommendation sets (RAs' recommended alternatives) are presented in a different format. The results of an online experiment indicate that the way a RA provides recommendations has a substantial impact on consumer decision-making in the online environment, and will provide more

[1] http://www.cbs.nl/nr/rdonlyres/de06bb4a-f5be-44ed-8217-180ae2912d4a/0/pb09n068.pdf
[2] http://www.cbs.nl/nl-NL/menu/themas/bedrijven/publicaties/digitale-economie/artikelen/2006-1921-wm.htm

[3] In this study, the terms online environment, electronic shopping environment, and online shopping environment will be used interchangeably.
[4] A Recommendation Agent is an electronic tool that assists consumers in the initial screening of alternatives that are available in the database of an online vendor. Based on a set of attributes provided by consumers, a RA will in return recommend a set of products, which are likely to be the most promising products to consider for that particular consumer.

understanding in what way online vendors could implement these RAs in such a way, that consumers who gather product information and make purchase decisions on their site are being influenced to increase the probability of a purchase, and inducing them to opt for more expensive alternatives without compromising decision effort, decision quality and their satisfaction with the RAs' recommendations.

1.1 SCOPE & PURPOSE

Given the rapid growth of the number of consumers that purchase products online and the increase in the number of companies that respond to this growth, there is a need to understand the role RAs play in consumer decision-making on the Internet. Behavioral insights will not only contribute to the effectiveness of companies' online selling strategies, but will also extend the past research and provide an interesting foundation for future research.

Many papers are dedicated to this subject. However, these studies are mainly focused on the underlying algorithms of RAs and most of these papers are especially focused on the usefulness of RAs to consumers, and in what way consumers respond to these systems. Furthermore, much research done on consumer decision-making involving a product decision task is based on a forced product choice. Just as consumers have to possibility of not choosing at all in the physical world, this study will include this option also. The aim of this research to investigate consumer decision-making under different conditions of recommendation sets. In other words, investigating to what extend consumers will be affected in their decision-making by altering the way RAs present their recommended alternatives. I therefore propose that the extent to which consumers are influenced will depend on the way RAs present recommendations and the context in which these alternatives are presented. The central problem statement is therefore:

"What is the effect on consumers' decisions when recommendation sets are presented differently?"

Additionally, I hope to extend the existing literature by investigating whether consumers can be influenced and induced without at the same time compromising consumers' decision effort, decision quality and satisfaction.

To present an answer to the central problem statement at the end of the thesis, it will be necessary to get an answer to several research questions during this thesis. An online experiment with 186 respondents will contribute to the answering of these questions and deliver empirical evidence with respect to the central problem statement.

1.2 STRUCTURE

This thesis is further organized as follows. First, the relevant literature on decision tools and the decision process in the online environment are discussed. Then a set of hypotheses will be developed. These hypotheses will help to explain in what way consumers will be affected in their decision-making in an online environment when a recommendation set is presented differently. This is followed by a description of the method used to test these hypotheses. Finally, the results of the findings will be reported and conclude the study with a general conclusion of the findings along with marketing implications, limitations and recommendations for future research.

2. DECISION TOOLS IN THE ONLINE ENVIRONMENT

Internet made it possible to bridge physical distance, as a result the range of markets increased substantially for companies. Another outcome of the Internet is that the constraints of physical space no longer dictate the organization of information in electronic shopping environments (Bellman et al. 2006). Due to the lack of physical constraints with respect to product display online vendors could, theoretically, offer an infinite amount of products on their virtual shelf space. Furthermore, the cost of searching for product information across online vendors is substantially lower than in the physical world (Bakos 1997; Lynch and Ariely 2000). As a result, consumers are fed up with vast amount of product information about market offerings. Having such great amount of product information could be convenient to consumers in a way that this could result in better purchase decisions. However, due to the cognitive limitations of human information processing (Simon 1955), the difficulty of having such extensive product information is that consumers may be unable to adequately process all that information. A response to the problem of the cognitive limitations of human information processing is the emergence of RAs to assist consumers with respect to the problem of information overload (Maes 1994) in the online shopping environment.

2.1 PHYSICAL vs. DIGITAL

With the assistance of RAs consumers can delegate decisions or portions of decisions to these tools (Ariely et al. 1999). This tendency of consumers to entrust portions of decisions to RAs is not uncommon. In the physical world consumers tend to delegate decisions as well. In the physical world consumers often use others as sources of information and/or support in their decision-making process (e.g. Price and Feick 1984; Kiecker and Hartman 1994). Senecal and Nantel (2002) state that online recommendations are sorted into three categories: (1) other consumers (e.g. close friends, relatives and acquaintances), (2) human experts (e.g. salespersons, independent experts) and (3) expert systems or consumer decision support systems, such as the RA used in this study. We know much on how the first two sources can influence consumers and yet know little about how RAs could influence consumers. Consumers often receive recommendations by others, and just as a RA, they also only consider a subset of all attributes that may not reflect the true preferences of the consumer. So in sense of way

the role of RAs in the online environment is similar to the first two sources. Following this reasoning, I expect that RAs can influence consumers.

As proposed before, the extent to which consumers are influenced by a RA will depend on the way RAs present recommendations. Changing the recommendation sets of RAs can influence the way in which consumers make purchase decisions. For instance, online vendors could alter RAs in a way that consumers are induced to choose particular products instead of assisting them in an unbiased way to make a product choice which best suits their preferences. One could argue that such an online selling strategy, described in the situation above, might be suboptimal and leading to situations that are undesirable from a social welfare viewpoint. However, if we quick examine the physical world, and for example supermarkets, we will realize once again that this is not unusual. Supermarkets frame through shelf spaces to induce consumers to choose certain products (Hanson and Kysar, 1999b). The alternatives provided to consumers induced them to choose more expensive alternatives or larger quantities. Consumers are also induced to choose middle options. Adding a highly priced good to the mix increases the medium range (which was before the higher range) to be chosen. Also the addition of an inferior option increases the market share of the superior option. This is inconsistent with the classical theory of value maximization, in which the preference between alternatives is independent of the set of alternatives under consideration. Hence, if a consumer prefers product x to product y in one choice set, then y cannot be preferred to x in another choice set when a third product is added to the set (Simonson and Tversky 1992). Evidence however, suggests otherwise. Consumers are influenced by the set of alternatives from which they can make a choice, and characteristics of the set of alternatives can evoke different strategies to solve a decision problem (e.g. Tversky and Kahneman 1981; Payne et al. 1992). What strategy consumers choose to solve a decision problem will also depend on individual factors such as individual processing capacities of information (Bettman et al. 1990), knowledge or expertise and type of expertise (e.g. Alba and Hutchinson 1987; Hoeffler and Ariely 1999; Coupy et al. 1998; Shanteau 1988; 1992). The point of the examples mentioned earlier is simple, I see similarities between a shelf in a supermarket and the recommendation set of a RA. Just as supermarkets can present their products in certain way to induce consumers to choose certain products, I believe that RAs can present products to consumers in a similar manner. In the next

section I will give a definition of a RA, and define the RA and the RA-model used in this study.

2.2 RECOMMENDATION AGENTS

A RA takes the interests or preferences of consumers into account and provides recommendations accordingly. I conceptualize a RA as an electronic tool that aids consumers in the initial screening of alternatives that are available in the database of an online vendor. Based on a set of attributes selected by a consumer, a RA will in return recommend a set of products (recommendation set), which are likely to be the most promising products to consider for that particular consumer. There are endless amounts of websites which incorporate RAs, thus I will only give two distinctive examples. Wehkamp.nl (www.wehkamp.nl) is a particular online vendor where consumers can search for and buy products out of its own assortment. Kieskeurig.nl (www.kieskeurig.nl) is a site many people use to acquire information about products. If consumers made their choice, Kieskeurig.nl will help consumers in selecting a product from among different vendors. This is an example of a comparing site or third-party provider. Although these two types of online vendors might have different motivations for including certain attributes in the RA, this research pertains equally to both types.

In order to deliver answers to the research questions, it is important to define which type of RA is used in this study and in what kind of environment. While different types of RAs exist and used in a wide range of areas, the RA selected in this research is an attribute-based RA, also called a content-filtering RA, provided by an online vendor where consumers can search for product information and purchase products. This RA generates recommendation based on consumers' preferred product attributes. The focus of this study is on these RAs' recommendations and the impact on consumers' decisions only.

In this study, for each product, three RA-models are used. Two models provide a list of five recommended alternatives and one model provides a list of six recommended alternatives. The alternatives are described by their brand, model name and product attributes. All products in these models are displayed in the format of a comparison matrix (CM). In this CM all products can be compared by their attributes. The RA-models used in this study are (Appendix I and II):

1. A high conflict model, in this model none of the products has decisive advantage in terms of their relation among attributes. Thus, a situation where consumers are confronted with a recommendation set, in which alternatives are relatively equally attractive but not identical.
2. A low conflict model, in this model there is less conflict because consumers are confronted with a recommendation set, in which alternatives' attributes are further away from consumers' initially selected preferences and there is less conflict in the relation among attributes.
3. A low conflict model extended with an extreme option, this model is the same as the second model, except that this model is extended with an extreme option. This extreme option is dominated by another product (product E), and this product is, compared to the dominant product, overpriced given its product attributes.

The next chapter will, based on relevant literature on consumer decision-making, explain why the use of a RA is a helpful tool for consumers who want to buy products online.

3. CONSUMER DECISION-MAKING AND RAs

When consumers make purchase decisions in complex environments they are often unable to evaluate all available alternatives in great depth prior to making a choice (Beach 1993) due to their limited cognitive capacity (Simon 1955). According to Payne (1982; also Payne et al. 1988) consumers tend to use a two-stage decision making process to come to a decision, in which the depth of information processing varies by stage. When making a purchase decision, a consumer will first screen a large set of available products (i.e. the initial screening stage) in a database, without evaluating them in great depth, and identify a subset of the most promising alternatives (i.e. the consideration set or recommendation set). Subsequently (i.e. at the in-depth comparison stage), the consumer evaluates the consideration set in more depth, by performing comparisons based on important attributes before committing to an alternative (Edwards and Fasolo 2001; Häubl and Trifts 2000). Given this tendency of consumers to use this two-stage decision process, RAs can be very useful during this process. Most common RAs used on the Internet today facilitate this two-stage decision process. More specifically, a common attribute-based RA assists consumers in the initial screening to determine which product are worth considering, given their attributes, and allows for in-depth comparison of product alternatives in the recommendation set. In the next section I will examine consumer decision-making with conflict.

3.1 CONSUMER DECISION-MAKING WITH CONFLICT

When a RA recommends a set of alternatives to consumers they have to choose between several alternatives. Choosing one alternative can be a difficult task and often requires trade-offs between attributes. As a result, this generates conflict (Luce 1998). According the classical theory of decision-making it is assumed that conflict plays no role. This theory considers that preferences are complete and that information processing is costless. This notion would imply that consumers consider all possible alternatives before arriving at a final product choice. In reality, and in particular on the Internet, information on all possible product alternatives is either unavailable or consumers may be unable to adequately process all information due to their cognitive limitations of information processing (Simon 1955). In practice however, consumers are willing to settle for less accurate decisions in terms of their preferences in return for a reduction in effort (Bettman et al. 1990, Johnson and Payne 1985). Thus, consumers often have to

make a product decision, in which their choice is not based on well-established and clearly ranked preferences. In such situations, for a consumer to know which alternative he/she prefers, while not knowing whether he/she wants them equally, can be difficult. As such, this could result in indecision and a reason to defer a final product choice. In this study, I conceptualize a situation where none of the products recommended by the RA has a decisive advantage in terms of their relation among attributes as a situation of high conflict. Thus, in high conflict situation consumers are confronted with a recommendation set, in which alternatives are relatively equally attractive but not identical. The opposite, a low conflict situation, is a situation where one alternative dominates the other alternatives (Dhar 1997).

When consumers make purchase decisions in complex environments they are often unable evaluate all alternatives. Instead, consumers tend to use a two-stage decision process (Payne 1982; Payne et al. 1988) to arrive at their final product choice. As discussed, RAs can be very useful to consumers during this process. However, attribute-based RAs recommend a set of products which are based on a set of attributes that are selected by the consumer. The recommendations a RA presents are most likely to contain the most promising products for that consumer. In other words, the RA often presents alternatives with similar attributes that are relatively equally attractive. In such high conflict setting, consumers' indecision may lead to a situation in which consumers avoid commitment by not choosing at all, and this, in turn, may result in the loss of a potential customer. This off course is undesirable from a commercial perspective. Altering the way RAs present their recommended alternatives could influence consumers in such a way, that the degree in which consumers find it difficult to make a choice decreases, and at the same time lower the probability of consumers who defer a choice.

Much research done on consumer decision-making is based on situations where consumers are forced to make a product choice. In the real world this clear is not realistic. Since there is no restriction with respect to time of purchase or point of purchase in the real world, consumers also have the freedom of not choosing a product at all or extend their search and seek for new alternatives in the same or in a different

environment (e.g. other online vendor). The experiment contributing to this research will include the option of not choosing a product alternative at all.

3.2 CONSUMER DECISION-MAKING AND CONSUMER EXPERTISE

Before consumers can make a purchase decision they have to express their preferences and decide what criteria or strategy to use to make their choice. As discussed before, consumers often have to make decisions, in which their choice construction is not based on well-established and clearly ranked preferences. So they often construct their preferences on the spot, which can lead to indecision and product deferral. This notion implies that consumers construct their preferences for every decision. In reality, however, a consumers' knowledge of these decision criteria can vary greatly for different alternatives. Over time, consumers may have developed a great deal of knowledge within a certain product category. These consumers are likely to know which attributes are most important. Thus for consumers with high product expertise the decision criteria are likely to be readily available and will experience the decision as relatively easy (Alba and Hutchinson 1987). Consumers that are less knowledgeable about a product may need to construct their choice on the spot and may experience indecision. In the next chapter hypotheses will be formulated to present an answer to the central problem statement at the end of this study.

4. HYPOTHESES

In this chapter, all factors of importance based theoretical and empirical work along with the expectations of this study are discussed. Hypotheses will be formulated in order to empirically test the influence a RA has on consumer decision-making in the online environment, in terms of decision effort, decision quality, choice conflict, and consumer expertise when recommendation sets are presented differently.

4.1 THE EFFECT OF RAS RECOMMENDATIONS ON DECISION EFFORT

The use of RAs affects consumers in their decision-making process. During this process consumers have to put in some amount of decision effort to come to a final product choice. This decision effort is the amount of effort a consumer uses to process information, evaluate alternatives and make a product decision. There are several ways to measure the decision effort of a consumer during the decision process. One way is to measure decision time, that is, the time a consumer spends to search for product information and make a product decision.

Some studies found that the use of a RA decreased consumers' decision time (Hostler and Guimaraes 2005; Vijayasarathy and Jones 2001). However, Olson and Widing (2002) noted that the use of a RA increased consumers' decision time as well as their perceived decision time. So, evidence concerning decision time with the use of a RA is still mixed. This study is focused on decision-making with the use of a RA. Decision time will be measured by investigating the average time a respondent took to complete the questionnaire under different recommendation sets. I expect that in a high conflict recommendation set (see Appendix I and II, Figure 1), in which the alternatives are relatively equally attractive, consumers will spend more time completing the survey than in a situation where they are confronted with a low conflict recommendation set (see Appendix I and II, Figure 2). Since the first part of the questionnaire is the same for every experiment group, the differences in time will mainly arise from the second part of the questionnaire, in which consumers are confronted with a case concerning a product choice. Hence, the time a consumer spends to complete the questionnaire will relate to the time it took to make a decision and in turn on decision effort.

Another way to measure decision effort is to measure the amount of product information search. This refers to the number of product alternatives for which detailed information is acquired (Moorthy et al. 1997). Häubl and Trifts (2000) observed in their study that consumers viewed detailed product information of substantially fewer alternatives when a RA was used (i.e. the in-depth search set). In this study, three RA-models are used. These models provide a fixed list of recommended alternatives. All products in these models are displayed in the format of a comparison matrix (CM). In this CM all products can be compared by their attributes. Since this is a simplified reproduction of a recommendation set and products with only a few attributes, consumers can compare products and view product information at a glance. Therefore, another indicator of decision effort will be used.

This other indicator of decision effort is the degree in which respondents find it difficult to make a product choice among the alternatives provided by the RA. It is expected that the number of consumers that find it difficult to make a decision will, compared to a high conflict recommendation set, decrease in a low conflict recommendation set.
So it therefore hypothesized that

H1: *Compared to a high conflict recommendation set, the amount of decision effort a consumer uses to come to a decision will decrease in a low conflict recommendation set.*

- H1a: *Compared to high conflict recommendation set, the average time consumers take to make a decision decreases in a low conflict recommendation set.*
- H1b: *Compared to a high conflict recommendation set, the number of consumers that find it difficult to make a decision decreases in a low conflict recommendation set.*

4.2 THE EFFECT OF RAs RECOMMENDATIONS ON DECISION QUALITY

If we talk about decision effort in a consumers' decision process, we also have to talk about decision quality. They are bound to each other like yin and yang. Decision quality can be measured both objectively and subjectively. A way to objectively measure decision quality is whether the consumer choses a non-dominant or a dominant product

alternative (Häubl and Trifts 2000). This approach is based on the idea of an objective standard for quality and requires a combination of objectively dominated and non-dominated alternatives. An alternative is dominated if there is at least one other alternative that is superior on at least one attribute while not being inferior on any attribute. By contrast, an alternative is non-dominated if no other alternative is superior on any attribute without, at the same time, being inferior on at least one other attribute. In this regard, Häubl and Trifts (2000) noted that the use of a RA leads to a larger share of non-dominant alternatives in the set of alternatives considered seriously for purchase. This measurement requires alternatives that are known to be non-dominated. In other words, one first has to know the attributes that are more weighted by consumers than other attributes. In order to acquire attribute importance weights, they asked subjects to provide their minimum-acceptable attribute levels for the alternatives to be included in their personalized recommendation set. My focus is on RAs' recommendation sets only and consumer decision-making accordingly. This means that in this experiment consumers are not able to indicate their preferences in terms of product attributes, and the RA will not screen available products in a database to determine which products are the most promising given the consumers' indicated preferences. Therefore, other ways to measure decision quality will be explored.

Another way of measuring decision quality is product switching, that is, whether a consumer, when given the opportunity to do so, wants to change his or her decision after a purchase decision. Product switching is good indicator for decision quality, because it indicates a poor initial decision quality (Häubl and Trifts 2000) when consumers switch their products for another product at the end of their decision task. Häubl and Trifts (2000) discovered that using a RA decreased the probability of consumers who switch to another alternative, when given an opportunity to do so. Olson and Winding (2002) did find similar results. In this study consumers are given the opportunity to switch products after their initial decision. It is therefore expected, that consumers switch product less often when they are confronted with a low conflict recommendation set compared to a situation, in which they are confronted with a high conflict recommendation set.

Finally, a subjective indicator for decision quality is a consumers' degree of confidence in their purchase decision. Haubl and Trifts (2000) noted that the use of a RA leads to a higher degree of confidence. However, the effect is not highly significant. Other studies also found evidence that the use of a RA results in a higher degree of confidence (e.g. Olson and Widing 2002; Van der Heijden and Sorensen 2002). By contrast, Hostler et al. (2005) did not discover significant differences in consumers' decision confidence and Vijayasarathy and Jones (2001) observed a negative relationship between RA use and the degree of confidence, but they attribute this to consumers' lack of trust in the RA. Since the majority of researchers found a positive relation between confidence and decision quality compared to findings that noted no relation or a negative relation, I believe that this is a good indicator to measure the subjective quality of a person's purchase decision.

To empirically test the influence a RA has on consumer decision-making under different recommendation sets, the degree of confidence as indicator of decision quality will be measured. In this study, it is expected that altering the recommendation set to a set with less conflict will affect this indicator, and in this way have an effect on consumers' decision quality.
It is therefore hypothesized that

H2: *Compared to a high conflict recommendation set, consumers' decision quality will improve in a low conflict recommendation.*

- H2a: *Compared to a high conflict recommendation set, the number of consumers who switch to another alternative (after their initial decision) will decrease in a low conflict recommendation set.*
- H2b: *Compared to a high conflict recommendation set, the number of consumers who have confidence in their purchase decision increases in a low conflict recommendation set.*

4.3 THE EFFECT OF RAs RECOMMENDATIONS ON CHOICE

Tversky and Shafir (1992) studied the effect of decision-making under conflict. In their research, subjects were confronted with a choice set in which two alternatives were relatively equally attractive (high conflict situation) and a choice set in which one

alternative dominated the other (low conflict situation). Subjects could then make a choice between the products or pay to acquire an additional alternative. They found that the percentage of subjects who requested an additional alternative was greater under high conflict. Dhar (1997) found similar results. It is expected that consumers are more likely to defer a choice when the choice between the alternatives in the recommendation set is perceived as being difficult (i.e. the high conflict situation) than when the choice is perceived as being relatively easy (i.e. a low conflict situation). When the choice is experienced as relatively easy, consumers are more willing to commit to a purchase and as a result an online vendor could increase her sales.
It is therefore hypothesized that

H3: *Compared to a high conflict recommendation set, the number of consumers that commit to a purchase will increase in a low conflict recommendation set.*

4.4 THE EFFECT OF THE ADDITION OF AN EXTREME OPTION ON CHOICE

The extent to which consumers are influenced by a RA will depend on the way RAs present recommendations is the focus of this study. As mentioned before, this is inconsistent with the theory of value maximization (i.e. Simonson and Tversky 1992). In their research, Simonson and Tversky (1992) state that value maximization does not account for the presence of context effects. Their research suggests that consumers not only consider the attribute values of a product, but also its position in the relevant choice set. This is also related to the notion that consumers are influenced by the set of alternatives from which they can make a choice, and that characteristics of the set of alternatives can evoke different strategies to solve a decision problem (e.g. Tversky and Kahneman 1981; Payne et al. 1992). Thus, lead to other decisions. Just as supermarkets can present their products in certain way to induce consumers to make other product decisions, I believe that RAs can present products to consumers to generate a similar effect. Therefore, it is assumed that when the low conflict recommendation set is extended with an extreme option (this option is, compared to the dominant product, overpriced given its product attributes), consumers will be induced to opt for more expensive alternatives.

It is therefore hypothesized that

H4: *Compared to a low conflict recommendation set, a low conflict recommendation set extended with an extreme option leads to a higher number of consumers who choose more expensive alternatives.*

4.5 THE EFFECT OF CONSUMER EXPERTISE

What strategy consumers choose to solve a decision problem will not only be driven by the set of alternatives from which they can make a choice, but will also depend on individual factors such as individual processing capacities of information (Bettman et al. 1990), knowledge or expertise and type of expertise (e.g. Alba and Hutchinson 1987; Hoeffler and Ariely 1999; Coupy et al. 1998; Shanteau 1988; 1992). Hoeffler and Ariely (1999) found that consumers who are new (less knowledgeable) to a product category construct their preferences on the spot and develop more stable preferences with experience in a domain. Coupey et al. (1998) noted that consumers who are highly familiar with a product category are less sensitive to framing effects during choice construction. As such, RA users with an average high product expertise are likely to have more stable, well-established and clearly ranked preferences and will be less affected by the different recommendation sets than consumers with an average low expertise.
It is therefore hypothesized that

H5: *Compared to a high conflict recommendation set, a low conflict recommendation set will have a greater effect on consumers with low expertise than on consumers with high expertise.*

- H5a: *The difference in the extent to which consumers find it difficult to make a decision in high conflict recommendation set and a low conflict recommendation set, will be larger for consumers with low expertise than for consumers with high expertise.*
- H5b: *The difference in the extent to which consumers have confidence in their decision in high conflict recommendation set and a low conflict recommendation set, will be larger for consumers with low expertise than for consumers with high expertise.*

5. METHODOLOGY

In this chapter, the method used to test the formulated hypotheses will be discussed.

5.1 SAMPLE

A convenience sample of 186 subjects was recruited by e-mail. Potential participants did not know in advance the types of products that were to be tested. The majority of subjects were between the ages of 25 and 35 years (38.2%). 43.5 percent of the recruited subjects were female (see Appendix V and Appendix VII, Figure 7.1 and 7.2 for additional information).

5.2 SURVEY STRUCTURE

In the first part of the survey, subjects were asked some general questions. In the second part, a controlled experiment simulating a RA's recommendation set was used in conducting this study. In this part, subjects were confronted with two cases. The first case was an online shopping task for a TV, and the second case was an online shopping task for a Laptop (see Appendix IV).

5.3 PROCEDURE SURVEY IN DETAIL

The survey was made in Dutch. The reason for this is that this study aims at the Dutch population, and the subjects recruited were all Dutch. Before the survey could be used to collect data, a pilot testing was done. Several subjects were asked to give a thorough look at the survey. Any misinterpreted words were replaced and mistakes corrected.

A cover story was used, so that the precise goal of this study would not be compromised. Subjects were told that a reputable company, which is mainly engaged in selling electronic products online, wanted to investigate how they can improve their website to better serve their customers. Subjects were told that the company wanted to find another way to integrate the online tools they make available for customers to search for products into their website.

With an experiment, both systematic and unsystematic variation will occur. Systematic variation will occur due to the manipulation of different conditions, while unsystematic variation will arise due unknown external factors. To retain the unsystematic variation to a minimum, subjects were randomly assigned to one of the three conditions. In order

to eliminate practice and boredom effects, no subjects have participated in more than one condition. Subjects first started the survey with some general questions. These questions were important to determine a subject's expertise in a given product category. These questions were the same for all participants. From thereon, subjects were told that they had to make two cases. The first case concerned a shopping task for a TV, and the second case concerned a shopping task for a Laptop. These two products were chosen because of their similarity in complexity, and the reason for two products instead of one, is the generalizability of the results. The two cases started with an introduction where subjects were told that they wanted to purchase a new TV and a Laptop with the use of a RA. After each introduction, a subject's preferences were stated for both a TV and a Laptop. Then, subjects were confronted with a recommendation set out of one of the three conditions. These conditions are (see Appendix I and II):

1. A high conflict model, in this model none of the products has decisive advantage in terms of their relation among attributes. Thus, a situation where consumers are confronted with a recommendation set, in which alternatives are relatively equally attractive but not identical.

2. A low conflict model, in this model there is less conflict because consumers are confronted with a recommendation set, in which alternatives' attributes are further away from consumers' initially selected preferences and there is less conflict in the relation among attributes.

3. A low conflict model extended with an extreme option, this model is the same as the second model, except that this model is extended with an extreme option. This extreme option is dominated by another product (product E), and this product is, compared to the dominant product, overpriced given its product attributes.

The recommended alternatives were described by their brand, model name and product attributes. All model names were fictitious but representative of the respective category. Each alternative for a TV was described on five attributes, and a Laptop on six attributes in addition to brand and model name. All these attributes were varied across

alternatives. The products in these models were displayed in the format of a comparison matrix (CM). In this CM all products could be compared by their attributes. They were then asked to make a decision based on the recommendations. After their decision, some questions were asked about that decision. At the end of the survey they were told that a new product model would be available in store next week. Subjects were then asked if they wanted this model instead (see Appendix III). The procedure was the same for both products.

5.4 MEASURES[5]

Gender, *age, online and internet* were related to subjects' personal characteristics. A subjects' gender was measured by 0 (Male) and 1 (Female). A subjects' age was divided into six groups: 1 (Younger than 25), 2 (25-35), 3 (36-44), 4 (45-54), 5 (55-64) and 6 (Older than 64). *Online* was measured by asking subjects if they purchased products online, a 5-point Likert scale was used, ranging from 1 (never) to 5 (very often). Internet was measured by asking subjects if they used the internet to acquire product information prior to purchasing a product, a 5-point Likert scale was used, ranging from 1 (never) to 5 (very often).

In order to test a consumers' decision effort, three variables were measured: *decision_time, TV_difficult* and *LT_difficult*. Subjects' decision time was measured by computing the time a subject took to complete the survey. To measure the degree in which consumers found it difficult to make a decision, a 7-point Likert scale was used, ranging from 1 (strongly disagree) to 7(strongly agree).

To test a consumers' decision quality, two variables were measured for each product category: *TV_confidence* and *TV_switch* for TV, and *LT_confidence* and *LT_switch* for Laptop. Firstly, consumers' confidence in their decision was measured by using a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). Secondly, a nominal scale was used to measure if consumers wanted to switch at the end of their decision task, with 0 (No) and 1 (Yes).

[5] The variables used for each question in this study are included in the survey in Appendix IV.

The amount of choice conflict a consumer experienced was measured by the degree consumers found it difficult to make a decision, and by the number of consumers who did not committed to a purchase. This was done by measuring *TV_difficult, LT_difficult,* and the number of consumers who did not committed to a product (variables *choiceTV* and *choiceLT*, with 0 = 'no choice' and 1 = 'choice').

The variable TV_*expertise and LT_expertise* were used to find possible confounding effects. To determine a subjects' expertise in a given product category, several variables were measured. Firstly, their domain experience in a certain product category was measured by asking subjects if they had ever purchased a TV or Laptop online. This was done with a nominal scale, with 0 (No) and 1 (Yes).

Secondly, their trade-off experience was measured by three variables for each product category: *TV_attributes, TV_time* and *TV_home* for the product category TV, and *LT_attributes, LT_time* and *LT_home* for the Laptops. *Attributes* was measured by asking consumers if they knew very well what product attributes to look for when they would buy a TV online, a Laptop respectively. A 7-point Likert scale was used, ranging from 1 (strongly disagree) to 7 (strongly agree). *TV_time* and *LT_time* were measured by asking subjects how long ago they had purchased this TV or Laptop online, with 0 (N/A), 1 (< 3 months), 2 (< 6 months), 3 (< 1 year), 4 (< 2 years), 5 (> 2 years). *TV_Home and LT_home* were measured by asking subjects if they had a TV or Laptop at home. This was done with nominal scale, with 0 (No) and 1 (Yes).

Thirdly, their product knowledge in a product category was measured by asking subjects to indicate the attributes they were familiar with (*TV_know* and *LT_know*). In total, twelve attributes for each product were given. For each attribute a nominal scale was used, with 0 (No) and 1 (Yes). Subject could either know none of the attributes (0) or all of them (12).

Lastly, satisfaction with the RAs' recommendations was also measured (*RAS_TV* and *RAS_LT*). This was done to test if the manipulations made in the recommendation sets would not undermine a consumers' satisfaction with the RA. This was measured by using a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree).

6. ANALYSIS AND RESULTS

This chapter will report in what way the data was cleaned and then report the analysis and the results of the survey.

6.1 DATA CLEANING AND PREPARATION

A total number of 186 subjects corresponded to the request to participate in the survey. Before the data could be used for analysis and results, a data exploration was done. After the exploration of the data, several things were done in order to get better results from the data. First, the variables *TV_online* and *TV_time* were compared. The frequencies of these variables were analyzed (see Appendix VI, Figure 1.1 and 1.2). The frequency of *TV_online* for 'No' was 169 and the frequency for *TV_time* for 'n/a' was 167. This means that two people did not bought a TV online, but did fill in a time of purchase where they actually had to fill in 'n/a' for this question. The same procedure was done for *LT_online* and *LT_time* (see Appendix VI, Figure 2.1 and 2.2) and again two errors were found ('No' = 148 and 'n/a' = 146). The variables were corrected by changing the errors for *TV_time* and *LT_time* into zero.

Secondly, *decision_time* was explored by a scatter plot and a histogram (see Appendix VI, Figure 3.1 and 3.2). There were several outliers that affect the results and the histogram was not normally distributed. For example, there was one respondent who took 9317 seconds (about 2 hours and 35 minutes) to complete the survey. This, off course, is not realistic and seriously affects the mean of *decision_time*. To get better results, all variables greater than 2700 were replaced by a missing value and a new histogram was made to analyze the new results (see Appendix VI, Figure 3.3). The outliers were gone, but still it was not normally distributed. A new variable (*ln_time*) was made to get a more normally distributes result (see Appendix VI, Figure 3.4).

Thirdly, *TV_expertise* and *LT_expertise* were explored. Several variables were initially measured to determine a consumers' expertise in a given product category. After a good exploration of the data, only two variables were included for this analysis. These variables were *TV_attributes* and *TV_know* for TV, and *LT_attributes* and *LT_know* for Laptop. Since the procedure for TV was the same for Laptops, only the procedure for TV will be illustrated. *TV_know* ranged from 0 (none of the attributes) to 12 (all of the

attributes) and *TV_attributes* was measured using a 7-point Likert scale. Firstly, *TV_know* was transformed into a 7-point scale with 1 (0, 1), 2 (2, 3), 3 (4, 5) 4, (6), 5 (7, 8), 6 (9, 10) and 7 (11, 12). To change the two variables into one variable for *TV_expertise*, the sum of the two variables were computed. After calculating the sum, TV_expertise ranged from 2 to 14.

Lastly, two new variables for each product were created to measure if there was a significant difference between a subject's expertise and the degree in which a subject found it difficult to make a product decision and their confidence in their decision. *TV_expertise* and *LT_expertise* were transformed (ranging from 2 to 14) into average low expertise (2, 3, 4, 5, 6, 7, 8 = 1) and average high expertise (9, 10, 11, 12, 13, 14 = 2).

6.2 HYPOTHESIS TEST

6.2.1 DECISION EFFORT

Two variables were measured in order to test if consumers' decision effort will decrease in a low conflict recommendation set (LCRS) compared to a high conflict recommendation set (HCRS). Firstly, the mean value of consumers' decision time (Ln Time) was measured under the different conditions.

Table 1: Mean values for decision time under a HCRS and a LCRS

	Ln Time		
	Mean	N	SE
HCRS	6,3304	72	,06473
LCRS	6,3149	56	,08302

The results in Table 1 show that compared to a HCRS, the values decreased in the LCRS condition. However, this decrease in decision time was only 0.24%.

Table 2: Independent t-test for decision time under a HCRS and a LCRS

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Ln Time	Equal variances assumed	,559	,456	,150	126	,881

The independent t-test shows whether these differences are significant. The main test results are summarized in Table 2. Levene's test is non-significant ($p = .456$, which is greater than .05). Therefore, the test statistics in the row labeled *Equal variances assumed* will be used. In this case the two-tailed value of p is .881 which is greater than .05, and so we can conclude that there is no significant difference between the means of these two groups. In conclusion, consumers' decision time did not significantly decrease in a LCRS (M = 6.31, SE = 0.08), compared to a HCRS (M = 6.33, SE = .06). The difference was non-significant and had a trivial effect size, with $r = .013$. The results do not support proposition H1a.

Secondly, the mean values for decision difficulty were measured for both products. The results are summarized in Table 3. Compared to a HCRS, for both TV and Laptop the values decreased in the LCRS condition (from 4.68 to 3.73 for TV and from 4.77 to 3.76 for Laptop).

Table 3: Mean values for the difficulty of the decision for each product under different conditions

	TV			Laptop		
	Mean	N	SE	Mean	N	SE
HCRS	4,68	73	,191	4,77	73	,175
LCRS	3,73	59	,196	3,76	59	,195

Given these values and the fact that a lower value intends a less difficult decision, it seems that consumers did find it more difficult to make a decision in a HCRS than in a LCRS. The independent t-test will show if these differences are significant.

Table 4: Independent t-test for the difficulty of the decision for each product under a HCRS and a LCRS

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
TV	Equal variances assumed	,158	,692	3,463	130	,001
Laptop	Equal variances assumed	,442	,507	3,830	130	,000

The main test results are summarized in Table 4. For these data, Levene's test is non-significant for both products ($p = .692$ for TV and $p = .507$ for Laptop, which is greater than .05). Therefore, the test statistics in the row labeled *Equal variances assumed* will be used. The t-test results, after having established that the assumption of homogeneity of variances is met, will present more information. In this case the two-tailed value of p is .001 for TV and .000 for Laptop, which is lower than .05, and so we can conclude that there is significant difference between the means of these two groups for both products. In conclusion, consumers experienced less difficulty in a LCRS (For TV, M = 3.73, SE = .196 and for Laptop, M = 3.76, SE = .195), than in a HCRS (For TV, M = 4.68, SE = .191 and for Laptop, M = 4.77, SE = .175). The effect size was a small sized effect, with $r = .29$ for TV, and a medium effect for Laptop, with $r = .32$. The results support proposition H1b. Although proposition H1a is not supported, the effect pointed in the right direction. H1b is fully supported, so we can conclude that there is support for proposition H1.

6.2.2 DECISION QUALITY

Two variables were measured to test whether consumers' decision quality increases in a LCRS compared to a HCRS. Firstly, the number of consumers who switch to another product was measured. The results summarized in Table 5 and 6 show that less consumers switch products in a LCRS (TV, 20.3% and Laptop, 5.1%) than in a HCRS (TV, 47.9% and Laptop, 30.1%).

Table 5: Crosstabs for TV switch for a HCRS and a LCRS

		HCRS TV	LCRS TV	Total
Yes	Count	35	12	47
	Expected Count	26,0	21,0	47,0
	% within condition	47,9%	20,3%	35,6%
No	Count	38	47	85
	Expected Count	47,0	38,0	85,0
	% within condition	52,1%	79,7%	64,4%
Total	Count	73	59	132
	Expected Count	73,0	59,0	132,0

Table 6: Crosstabs for Laptop switch for a HCRS and a LCRS

		HCRS Laptop	LCRS Laptop	Total
Yes	Count	22	3	25
	Expected Count	13,8	11,2	25,0
	% within condition	30,1%	5,1%	18,9%
No	Count	51	56	107
	Expected Count	59,2	47,8	107,0
	% within condition	69,9%	94,9%	81,1%
Total	Count	73	59	132
	Expected Count	73,0	59,0	132,0

The Pearson chi-square statistic test will test whether the two variables are independent. The value of the Pearson chi-square for both products is given in Table 7 and 8.

Table 7: Pearson's chi-square for TV switch

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10,845	1	,001

Table 8: Pearson's chi-square for Laptop switch

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13,339	1	,000

The value of the chi-square is for both products significant (.001 for TV and .000 for Laptop). This indicates that the RA used had a significant effect on whether consumers would switch. To conclude, for both products significant more consumers switched products in a HCRS than in a LCRS. At an alpha level of .05, a LCRS significantly decreases the likelihood of switching, RR = .462 for TV (0.273, 0.780) and RR = .229 for Laptop (0.078, 0.673). This represents the fact that a LCRS significantly decreases the odds of switching, OR = .227 for TV (0.127, 0.606) and OR = .124 (0.035, 0.440) for Laptop. This supports proposition H2a.

Secondly, the mean values for decision confidence were measured for both products. The results are summarized in Table 9. Compared to a HCRS, for both TV and Laptop the values increased in the LCRS condition (from 4.55 to 4.80 for TV, and from 4.59 to 4.97 for Laptop).

Table 9: Mean values for confidence in the decision for each product under different conditions

	TV			Laptop		
	Mean	N	SE	Mean	N	SE
HCRS	4,55	73	,162	4,59	73	,128
LCRS	4,80	59	,184	4,97	59	,171

Higher values intend more confidence in consumers' decision. It seems that consumers did have more confidence in their decision in a LCRS than in a HCRS. The main test results are summarized in Table 10. For these data, Levene's test is non-significant for both products ($p = .909$ for TV and $p = .202$ for Laptop, which is greater than .05).

Table 10: Independent t-test for confidence in the decision for each product under a HCRS and a LCRS

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
TV	Equal variances assumed	,013	,909	-1,017	130	,311
Laptop	Equal variances assumed	1,642	,202	-1,803	130	,074

In this case the two-tailed value of p is .311 for TV, and .074 for Laptop, which is greater than .05 for both products. It can be concluded that there is no significant difference between the means of these two groups for both products. In conclusion, consumers did not have more confidence in their decision in a LCRS (For TV, M = 4.80, SE = .184 and for Laptop, M = 4.97, SE = .171) than in a HCRS (For TV, M = 4.55, SE = .162 and for Laptop, M = 4.59, SE = .128). The differences were non-significant, however, for Laptop it did present a small sized effect, with $r = .17$, the effect for TV was trivial, with $r = .09$. The results do not support H2b. However, the results pointed in the right direction. Altogether, there is support for H2.

6.2.3 CHOICE UNDER DIFFERENT CONDITIONS

To test whether the number of consumers that commit to a purchase will increase in a LCRS compared to a HCRS, the relative number of consumers who made a product decision and the ones that did not make a choice will be compared. The results summarized in Table 11 and 12 show that fewer consumers deferred a choice in a LCRS (TV, 5.1% and Laptop, 1.7%) than in a HCRS (TV, 13.7% and Laptop, 19.2%).

Table 11: Crosstabs for TV choice for a HCRS and a LCRS

		HCRS	LCRS	Total
		TV	TV	
Choice	Count	63	56	119
	Expected Count	65,8	53,2	119,0
	% within condition	86,3%	94,9%	90,2%
No choice	Count	10	3	13
	Expected Count	7,2	5,8	13,0
	% within condition	13,7%	5,1%	9,8%
Total	Count	73	59	132
	Expected Count	73,0	59,0	132,0

Table 12: Crosstabs for Laptop choice for a HCRS and a LCRS

		HCRS	LCRS	Total
		Laptop	Laptop	
Choice	Count	59	58	117
	Expected Count	64,7	52,3	117,0
	% within condition	80,8%	98,3%	88,6%
No choice	Count	14	1	15
	Expected Count	8,3	6,7	15,0
	% within condition	19,2%	1,7%	11,4%
Total	Count	73	59	132
	Expected Count	73,0	59,0	132,0

The Pearson chi-square will test whether the two variables are independent. The value of the Pearson chi-square for both products is presented in Table 13 and 14.

Table 13: Pearson's chi-square for TV choice

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2,727	1	,099

Table 14: Pearson's chi-square for Laptop choice

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9,902	1	,002

The value of the chi-square differs for both products (.099 for TV and .002 for Laptop). This indicates that when consumers did the shopping task for a TV, the RA used did not have a significant effect on whether consumers would defer a choice. When consumers shopped for a Laptop, the RA used did have a significant effect on choice deferral. At an alpha level of .05, for Laptop a LCRS significantly decreases the likelihood of choice deferral, RR = .134 (0.020, 0.901). This represents the fact that a LCRS significantly decreases the odds of choice deferral, OR = 13.764 (1.753, 108.076). The results for Laptop support H3, and the results for TV pointed in the right direction, thus there is support for H3.

6.2.4 EXPENSIVE ALTERNATIVES

The mean values for the price of the product that consumers chose was computed to test whether consumers chose more expensive alternatives in a low conflict recommendation set extended with an extreme option (LCRS EXT) compared to a LCRS (see Appendix VII, Figure 7.3, 7.4 and 7.5). The results are summarized in Table 15. Compared to a LCRS, for both TV and Laptop the values increased in the LCRS EXT condition (from € 970.64 to € 1022.17 for TV, and from € 868.78 to € 903.43 for Laptop).

Table 15: Mean values for the price of the product that consumers chose for each product under different conditions

	TV			Laptop		
	Mean	N	SE	Mean	N	SE
LCRS	970,6429	56	11,24233	868,7759	58	12,06185
LCRS EXT	1022,1689	53	19,08308	903,4259	54	11,55882

A higher value means that consumers chose products with a higher price. It seems that consumers did choose more expensive alternatives in a LCRS EXT than in a LCRS. The main test results are summarized in Table 16. For these data, Levene's test is significant for TV ($p = .000$) and non-significant for Laptop ($p = .783$).

Table 16: Independent t-test for the price of the product that consumers chose for each product under a LCRS and LCRS EXT

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
TV	Equal variances assumed	26,918	,000	-2,357	107	,020
	Equal variances not assumed			-2,326	84,711	,022
Laptop	Equal variances assumed	,076	,783	-2,068	110	,041

In this case the two-tailed value of p is .022 for TV, and .041 for Laptop, which are both less than .05, and so we can conclude that for products there is a significant difference between the means of these two groups. In conclusion, consumers did choose more expensive alternatives in a LCRS EXT (For TV, M = 1022.1689, SE = 19.08308 and for Laptop, M = 903.4259, SE = 11.55882) than in a LCRS (For TV, M = 970.6429, SE = 11.24233 and for Laptop, M = 868.7759, SE = 12.06185). The differences were significant and did present a small sized effect, with $r = .22$ for TV and $r = .19$ for Laptop. The results support H4.

6.2.5 EFFECT OF EXPERTISE

The mean values for decision difficulty and confidence for consumers with an average high and an average low expertise were measured for both products in a HCRS and a LCRS (see Appendix VII, 7.6 and 7.7). The results for consumers with an average low expertise in TV are summarized in Table 17.

Table 17: mean values for difficulty and confidence for consumers with an average low expertise in TV

	TV Difficult			TV Confidence		
	Mean	N	SE	Mean	N	SE
HCRS	5,18	38	,223	4,00	38	,229
LCRS	3,92	24	,335	4,92	24	,248

Given these values, it seems that consumers with an average low expertise did find it less difficult to make a product decision and had more confidence in their decision in a LCRS. For these data, Levene's test is non-significant for both difficulty ($p = .172$) and confidence ($p = .697$). The main test results are summarized in Table 18.

Table 18: Independent t-test for difficulty and confidence for consumers with an average low expertise in TV

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Difficulty	Equal variances assumed	1,911	,172	3,283	60	,002
Confidence	Equal variances assumed	,173	,679	-2,622	60	,011

In this case the two-tailed value of p is .002 for difficulty, and .011 for confidence, which are both lower than .05, and so we can conclude that there is significant difference between the means of these two groups for both difficulty and confidence. In conclusion, consumers with an average low expertise did find it less difficult to make a decision and did have more confidence in their decision in a LCRS (difficulty, M = 3.92, SE = .335 and confidence, M = 4.92, SE = .248) compared to a HCRS (difficulty, M = 5.18, SE = .223 and confidence, M = 4.00, SE = .229). The differences were significant and did present a medium sized effect, with $r = .39$ for difficulty and $r = .32$ for confidence.

The results for consumers with an average high expertise in TV are summarized in Table 19. It seems that for consumers with an average high expertise both difficulty and confidence decreased in a LCRS compared to a HCRS.

Table 19: mean values for difficulty and confidence for consumers with an average high expertise TV

	TV Difficult			TV Confidence		
	Mean	N	SE	Mean	N	SE
HCRS	4,14	35	,293	5,14	35	,184
LCRS	3,60	35	,240	4,71	35	,261

For these data, Levene's test is non-significant for difficulty ($p = .172$) and significant for confidence ($p = .013$). The main test results are summarized in Table 20.

Table 20: Independent t-test for difficulty and confidence for consumers with an average high expertise in TV

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Difficulty	Equal variances assumed	1,902	,172	1,433	68	,156
Confidence	Equal variances not assumed			1,342	61,084	,185

In this case the two-tailed value of p is .156 for difficulty, and .0185 for confidence, which are both greater than .05, and so we can conclude that there is no significant difference between the means of these two groups for both difficulty and confidence. In conclusion, consumers with an average high expertise did not find it significant less difficult to make a decision and did not have significant more confidence in their decision in a LCRS (difficulty, M = 3.60, SE = .240 and confidence, M = 4.71, SE = .261) compared to a HCRS (difficulty, M = 4.14, SE = .293 and confidence, M = 5.14, SE = .184). The differences were non-significant, however, they did present a small sized effect, with $r = .17$ for difficulty and $r = .16$ for confidence. It should be noted that confidence actually decreased.

The same procedure was done for Laptop. The results for consumers with an average low expertise in Laptop are summarized in Table 21.

Table 21: mean values for difficulty and confidence for consumers with an average low expertise in Laptop

	Laptop Difficult			Laptop Confidence		
	Mean	N	SE	Mean	N	SE
HCRS	5,11	38	,252	4,42	38	,191
LCRS	3,96	24	,304	4,92	24	,216

Again, it seems that consumers with an average low expertise did find it less difficult to make a product decision and had more confidence in their decision in a LCRS. For these data, Levene's test is non-significant for both difficulty ($p = .675$) and confidence ($p = .523$). The main test results are summarized in Table 22.

Table 22: Independent t-test for difficulty and confidence for consumers with an average low expertise in Laptop

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Difficulty	Equal variances assumed	,177	,675	2,874	60	,006
Confidence	Equal variances assumed	,413	,523	-1,677	60	,099

In this case the two-tailed value of p is .006 for difficulty, and .099 for confidence, and so we can conclude that there is a significant difference between the means of these two groups for difficulty, but not for confidence. In conclusion, consumers with an average low expertise did find it significant less difficult to make a decision, but did not have significant more confidence in their decision in a LCRS (difficulty, M = 3.96, SE = .304 and confidence, M = 4.92, SE = .216) compared to a HCRS (difficulty, M = 5.11, SE = .252 and confidence, M = 4.42, SE = .191). The difference was significant for difficulty and presented a medium sized effect, with $r = .35$. Confidence was non-significant, however, it did present a small sized effect, with $r = .21$.

The results for consumers with an average high expertise in Laptop are summarized in Table 23. It seems that for consumers with an average high expertise, difficulty decreased and confidence increased in a LCRS.

Table 23: mean values for difficulty and confidence for consumers with an average high expertise in Laptop

	Laptop Difficult			Laptop Confidence		
	Mean	N	SE	Mean	N	SE
HCRS	4,40	35	,229	4,77	35	,164
LCRS	3,63	35	,256	5,00	35	,249

For these data, Levene's test is non-significant for difficulty ($p = .452$) and significant for confidence ($p = .018$). The main test results are illustrated in Table 24.

Table 24: Independent t-test for difficulty and confidence for consumers with an average high expertise in Laptop

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Difficulty	Equal variances assumed	,571	,452	2,245	68	,028
Confidence	Equal variances not assumed			-,765	58,864	,447

In this case the two-tailed value of p is .028 for difficulty, and .447 for confidence, and so we can conclude that consumers with an average high expertise did find it significantly less difficult to make a decision in a LCRS, but did not have significantly more confidence in their decision in a LCRS (difficulty, M = 3.63, SE = .256 and confidence, M = 5.00, SE = .249) compared to a HCRS (difficulty, M = 4.40, SE = .229 and confidence, M = 4.77, SE = .164). The difference was significant for difficulty and presented a small sized effect, with $r = .26$. Confidence was non-significant and had a trivial sized effect, with $r = .09$.

6.7 OTHER RESULTS

6.7.1 SATISFACTION

To test whether consumers' satisfaction would not decrease when consumers were confronted with a LCRS, consumers' satisfaction with the RA was measured (see Appendix VII, Figure 7.8). Compared to a HCRS, for both TV and Laptop the values increased in the LCRS condition. Table 21 shows an increase from 4.81 to 5.03 for TV and from 4.73 to 5.20 for Laptop.

Table 25: Mean values for satisfaction with the RA's recommendations for each product under a HCRS and a LCRS

	TV			Laptop		
	Mean	N	SE	Mean	N	SE
HCRS	4,81	73	,148	4,73	73	,155
LCRS	5,03	59	,153	5,20	59	,120

Higher values intend more satisfaction with the RAs' recommended alternatives. The main test results of the independent t-test are summarized in Table 22. Levene's test is non-significant for TV (p = .909) and significant for Laptop (p = .007). Therefore, the test statistics in the row labeled *Equal variances assumed* will be used for TV and *Equal variances not assumed* for Laptop.

Table 26: Independent t-test for satisfaction with the RA's recommendations for each product under a HCRS and a LCRS

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
TV	Equal variances assumed	,354	,553	3,463	130	,295
Laptop	Equal variances assumed	7,451	,007	3,830	130	,021
	Equal variances not assumed			3,829	127,436	,016

In this case the two-tailed value of p is .295 for TV and .016 for Laptop, and so we can conclude that there is no significant difference between the means of these two groups

for TV, but there is a significant difference between the means of the two groups for Laptop. Consumers did not have more satisfaction with the recommendations for TV in a LCRS (M = 5.03, SE = 0.153), than with the recommendations for TV in a HCRS (M = 4.81, SE = 0.148). However, consumers did have more satisfaction with the recommendations for a Laptop in the LCRS (M = 5.20, SE = 0.120), than with the recommendations for a Laptop in the HCRS (M = 4.73, SE = 0.155). The difference for TV was non-significant, however, it did present a small sized effect, with $r = .29$. For Laptop the difference was significant, it presented a medium sized effect, with $r = .32$. To conclude, satisfaction was not compromised by the different recommendation sets, on the contrary, there is support that satisfaction increased in a LCRS compared to HCRS.

The same procedure was done to compare the LCRS with the LCRS EXT (M = 4.81, SE = 0.181 for TV) and (M = 5.06, SE = 0.166 for Laptop). Although satisfaction did decrease in a LCRS EXT for both products, there was no significant difference between the two conditions ($p = .355$ for TV and $p = .467$ for Laptop). Satisfaction with the recommended alternatives did decrease compared to a LCRS, however, it did not decrease compared to a HCRS.

7. CONCLUSIONS

Most online vendors provide assistance in the form of a RA to help consumers to process information and make product decisions. RAs have the technological possibility to alternate and customize the shopping environment for each single consumer. This way they are, more than a conventional ('physical') shop, capable of influencing purchase decision making on an individual level. Therefore, when consumers tend to rely on these RAs in their decision process, they open a potential gateway to influence and manipulation. This is supported by the findings of the presented study. These findings suggest that consumers' choice preferences indeed can be influenced in a systematic manner by altering the set of recommendations and the context in which these alternatives are presented.

This chapter presents the conclusions of the study. Similar to the categorization proposed in the methodology (Chapter 5), conclusions in the first paragraph are drawn with respect to decision effort, decision quality, decision choice and decision making under expensive alternatives. General conclusions are drawn with regard to decision expertise. The chapter builds on these conclusions in the subsequent paragraph to deduce marketing implications. Finally the chapter explicates the limitations of the research performed and gives recommendations for future research. Although not all propositions in this study were significant for both products, they did point in the right direction, present interesting results and provide solid ground for future research.

7.1 CONCLUSIONS

Decision effort

The results reported in this study did not support that decision *time* significantly decreased in a LCRS. An approximately equal amount of time was used to complete the surveys in this experiment. A trivial decrease was shown in the recommendation set, where respondents were asked to choose among product alternatives with more divergent attributes. However, this decrease was non-significant.

The results of the experiment support that the degree in which consumers find it difficult (*difficulty perception*) to make a product decision decreases for both alternatives provided by the RA in a LCRS compared to a set with high conflict (as

illustrated in Appendix VII, Figure 7.6). The experiment proved that alteration of the given recommendation set, by changing from a set of products with more or less equal attributes to a set of relative divergent attributes, consumers' perceived difficulty, with regard to the product (purchase) decision process, can be decreased. This is not a surprising outcome. It does however, support the principal idea of the RA capable to influence psychological decision processes. For example, RAs can diminish indecisiveness between alternatives and take away reasons to defer a final product choice.

Decision quality

The results of this study proofed that, compared to a HCRS, in a LCRS significant fewer consumers switch at the end of their decision task. The fact that fewer consumers switched their product means that they made a better initial product decision and that they are probably more confident in their choice.

The study however, did not report a significant increase in consumers' decision confidence (see Appendix VII, Figure 7.7). Although the results did not measure any significant difference between a HCRS and a LCRS for both products, they did however point in the right direction and showed an increase. This increase is non-significant, but it could be enough for some consumers to hold on to their initial product choice.

Choice under different conditions

The experiment showed a decreasing number of product deferral when alternatives characterized by divergent attributes (leading to less choice conflict situations) were recommended to test-consumers. Recommending such alternatives led to an increase of consumers that commit to a purchase. The thesis that denotes the negative causality between LCRS and product choice deferral was proven in the LCRS Laptop experiment were given LCRS alternatives led to a significant decrease in consumer deferrals. The results for TV were non-significant, but the amount of product deferral did decrease. Thus, recommending alternatives that have less conflict in the relation among attributes will decrease indecisiveness in a way that consumers find it less difficult to make a decision. As a result, consumers will be more likely to commit to a purchase. From a managerial perspective this means that sales increase.

Expensive alternatives

As a consequence of adding a relatively overpriced dominated product in the recommendation set, the experiment led to a shift in consumers' preferences (see Appendix VII, Figure 7.3 and 7.4). Under these circumstances, consumers bought more expensive alternatives (see Appendix VII, Figure 7.5). An explanation for this shift could be that the rate at which subjects are willing to substitute one attribute for another varies with attribute range. Preference orderings in such a setting can change across contents that differ only in attribute range for the same recommendation set (Mellers and Cooke 1994). Also, the relative weight reflects the ranges of attribute values across the alternatives in the choice set, the greater the range, the greater the importance of the attribute (Goldstein 1990).

Based on the results of the experiment and the theoretical implications mentioned by Mellers and Cooke (1994) and Goldstein (1990), conclusions can be drawn regarding the attribute price when adding overpriced products to a recommendation set. Adding overpriced products increases the range of the attribute price. As a result of this, this attribute will become more important in the product decision process, which in turn could lead to a situation in which consumers deal with decision problems with more selective attention.

Effect of expertise

The study reported here, suggests that for consumers who are less experienced or less knowledgeable in a product category, a low conflict set will have more impact on consumers' difficulty and confidence than for consumers who are more experienced. One reason that the effect is greater for less knowledgeable consumers could be that they use more simplified decision heuristics to solve a decision problem while consumers with high expertise will try to hang on more compensatory decision strategies.

Satisfaction

This study proofed that satisfaction increased in a LCRS for Laptops, the results for TV were non-significant, but did increase (see Appendix VII, Figure 7.8). The experiment proved that alteration of the given recommendation set, by changing from a set of

products with more or less equal attributes to a set of relative divergent attributes, consumers will be more satisfied with the recommended alternatives. Again, this supports the principal idea of the RA capable to influence psychological decision processes. It should be noted however, that in the LCRS EXT consumers' satisfaction with the recommended alternatives decreased compared to a LCRS. For TV, it decreased to the same level as in the HCRS, for Laptop it decreased, but still remained above the HCRS satisfaction level. This suggests that there are limitations in alterations of RAs. For example, this could be a sign that consumers recognize the RA as unfair. This will be further explained in the next chapter.

7.2 MARKETING IMPLICATIONS

Advantages/opportunities

Marketers can increase their product sales by altering the recommendation set to a set with less choice conflict. A choice set with less conflict has a positive psychological effect on consumers' perceived effort and quality during the decision process. Consumers experience less difficulty to make a product choice and have more confidence in their initial product choice.

The choice experiment indicates that online marketers can manage sales volume by adding (or removing) alternative options in the online vending environment. For example, 'higher range' products (in terms of price) can become 'middle range' products by adding product(s) that exceed a consumer's initial price preference. Such alternations in the presentation design of online offers will have significant psychological effects on the way the average consumer arrives at his or hers final product choice. Adding an expensive option will cause a shift in consumers' product preference and as a result consumers will opt for more expensive alternatives (consumers spend approximately 50 Euro more for a TV and 35 Euro for a Laptop). The results indicate that other factors, aside from attribute values, play a prominent role in a recommendation set and marketers should consider these factors when promoting products online.

Moreover, altering the recommendation set to a set with less conflict or adding a product that exceeds a consumer's initial price preference does not harm consumers'

satisfaction with the RA's recommended alternatives (although it decreases in LCRS EXT compared to a LCRS, it does not decrease compared to a HCRS).

Disadvantages/threats

It is important that satisfaction is not compromised. If satisfaction with the recommended alternatives lacks, consumers will very likely extend their search by going to another online vendor. Apart from this, a displeased customer will probably not return to this particular site to shop for products in the future. So if marketers alter the way a RA recommends alternatives, it is important to monitor and respond to consumers' satisfaction with their RA. Furthermore, adding an extreme option can also be experienced as unfair, because the RA could instead have suggested a product that better met a consumer's initial attribute preference. In such situation, consumers could recognize that this RA does not operate in a consumer's best interest. As a result, satisfaction decreases and trust in that online vendor's site is likely to decline.

For example, Independer.nl[6] claims to be an independent comparison site. The site claims to show insurers in their recommendations that have no business relation with Independer.nl. For products of an insurer that does not have a contract with Independer.nl, the RA rarely recommends them in the top three of best deals based on a consumer's selected preferences. If a consumer asks to show the whole list of insurers that fits their profile, then some insurers will score better than the insurers recommended to them in the top three, but still do not end up in the top three of best deals. Furthermore, they present insurers with whom they have no commercial relationship using small neutral font and only accept consumer reviews from consumers that have insurance with one of the insurers Independer.nl has a business relation with. Thus, insurers with no business relation are not able to get good reviews and therefore score worse.

This example shows a potential threat of RA manipulation. Supermarkets may use the same methodology, but it seems that consumers are less critical in a physical store to

[6] http://nos.nl/artikel/203832-verzekeraars-independer-niet-onafhankelijk.html

these manipulations. Consumers will not drive five hours to a store, because they feel that this particular store is more trustful and fair. On the Internet this is a different story. Here, the cost of searching for product information across online vendors is substantially lower than in the physical world (Bakos 1997; Lynch and Ariely 2000). Since the lack of physical constraints, consumers can easily extend their search and go to another store. Given this reasoning, one could understand that consumers are far more critical on the Internet. So if marketers use the same methodology as supermarkets do, then they have to bear in mind that there are limits in manipulating the RA to induce consumers to opt for certain products in the online environment. When consumers start to doubt a particular online vendor and even worse, bad press and bad reviews spread around, then this could lead in the loss of customers and/or potential customers.

Conclusion

To conclude, this chapter illustrates the potential of recommendation sets to systematically influence consumers' choice preferences and induce consumers to opt for more expensive alternatives in an online environment through the design of the RA and their corresponding recommended alternatives in a choice set. Just as supermarkets can present their products in certain way to induce consumers to choose certain products, there should be no reason that online vendors could not employ this same methodology. It would be rather foolish if online vendors did not attempt to engage in similar manipulation. An online vendor armed with behavioral and psychological insights will take a giant leap into the future and will create a competitive advantage. Armed with these insights, marketers can offer consumers the idea that they made the best deal, without actually offering the best deal. However, customer satisfaction and trust should always be a high priority. Since there are a lot of stores to choose from on the Internet, it is easy to lose a customer. The implied challenge for marketers and IT technicians is to find ways to test and implement these findings in a real online setting.

7.3 LIMITATIONS

This study was conducted with a relatively small sample of 186 subjects, given that they were assigned to one of the three conditions, with 73 subjects in condition one, 59 subjects in condition two and 54 subjects in condition three. Therefore, it is reasonable to expect that a larger sample for each condition would lead to more accurate results for both products.

A second limitation is the sampling technique used for this study. In this study a convenience sample was used to recruit participants. This method is not representative of the entire population. This method suffers from sampling bias, which means the individuals who participate in this sample may not have characteristics that are systematically different than the characteristics that define the entire population. Furthermore, it is not theoretically meaningful to generalize to any population, which results in a low external validity of the study. However, this method is often the only feasible one for students with restricted time and resources.

A third limitation is that the experiment was conducted using an online survey. Therefore, the research results are likely to be influenced due to the absence of real life risk assessment accompanied by real life purchases of TV's and Laptops. It is possible that the test subjects behave differently or perform a decision task more seriously in real life purchase decisions. Creating such an environment would be extremely difficult and expensive for the purposes of this research. An experiment conducted in cooperation with an online store would be optimum, but for most researchers this will be hard to accomplish. Nonetheless, there could be other ways to get subjects more involved and to get more realistic results. An experiment using a simulated online store would be feasible. In such a setting, more contextual and visual options that resemble a real online store are possible. Additionally, giving subjects an incentive or by making the decision task consequential could get subjects more involved and could ensure that subjects conduct the experiment more seriously.

A fourth limitation of this study concerns the conclusions that are drawn regarding the attribute price when overpriced products are added to a recommendation set. This argument is not based on sound solutions that are based on scientific empirical facts.

The work performed here could, for the purposes of the research, never take into account all the other factors aside from attributes values (context specific matters like color, font of advertisement, format, brand image, etc.). This conclusion depends on the choice strategy used. There are numerous strategies used by consumers to solve a decision problem, depending on the product characteristics, the individual behavioral characteristics and the context in which the choice decision takes place.

Another limitation was the switching options. In this experimental design there was only one switching option for each product. The limitation of these options is that they were fixed and for each condition they were the same. The restricted possibilities of online survey tools are to blame. A setting where these options could vary according to consumers' initial choice would likely result in more realistic switching behavior.

A final limitation was the way decision time was measured. Decision time was measured by the time subjects took to complete the entire survey. This way, it is very plausible that the results are sensitive for errors. For example, some subjects may have read the two cases carefully while other may have skipped all the reading and just wanted to finish the survey as soon as possible. So a setting where time could be measured only where subjects have to make a product decision would likely in more accurate results.

Nonetheless, the experiment made every effort to simulate a real life scenario with the resources at hand. Product characteristics and purchase prices resemble the actual state of technology and the latest real life commercial pricing schemes. Furthermore, much emphasis was placed on the quality of the sample. Individual test subjects were strongly requested to 'empathise' with the experimental decision task as if they were in a real life case. This way the simulation of the real life decision task was able to attain a satisfactory degree of reality. To conclude, the limitations presented here are a window of opportunity for future research.

7.4 FUTURE RESEARCH

Most of the work to date has focused on the underlying algorithms of RAs or they are especially focused on the usefulness of RAs to consumers, and in what way consumers respond to these systems. Furthermore, many experiments investigated and compared to consumer decision making with and without the use of a RA. Since most online vendors make use of these systems in their online store today, further excavation in this subject could reveal treasures of unprecedented value.

This work can also be characterized as a pilot experiment. It presents potentially valuable insights for a future full-scale experiment. A full-scale experiment on certain hypotheses in this study will improve the chances of a clear outcome. For future research, this study can be broken into smaller parts, allowing different recommendation set characteristics as well as consumer-and product related aspects to be tested. For example, will the results concerning decision quality and decision effort be the same for other search goods? Will this also hold for experience goods? Another major area of research is the manipulation of consumers through the design of the RA. For example, will consumers buy more expensive alternatives if a dominated product is added in the LCRS EXT that has a very low price compared to the other products? Can the same results, found in the LCRS EXT, also be obtained without adding an option with a very? Perhaps these results can also be found when the recommended alternatives are put in a different format/context. These are all major areas for research. A future research done in cooperation with an online vendor would be of great value. Data can then be obtained from real life purchases by asking consumers to complete a survey after their shopping task. Analyzing the data of customers that visit the website can also be used to reveal usage patterns, customer satisfaction, effects of RA alterations and in predicting whether a customer is likely to purchase a product. These valuable insights can be obtained with a click-stream analysis.

Furthermore, this study can be seen as a sniper-shot, it is only one observation, a longitudinal study in the future could reveal more on consumers' decision strategy to solve choice problems under the same conditions or others. A longitudinal study would allow for detecting change as a result of repeated measurements of the same variables on the same respondents. If the same respondents are confronted with different

recommendation sets then the results can be used for pairwise comparison. This method would especially be useful to test whether consumers choose more expensive alternatives in recommendation set in which an extreme option is added to the choice set.

Moreover, further validation should be conducted in areas where there is only limited support or where unexpected or inconclusive results have been obtained, demonstrating a lack of knowledge in this area. On the area of expertise for example, there is much potential for future research.

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APPENDIX

APPENDIX I: RA MODELS FOR A TV

Figure 1: high conflict recommendation set (HCRS)

Merk / Model		Beeldscherm	Resolutie	Frequentie	Design	Prijs
A	Iconic	66 *cm*	1366 x 768 *pixels*	100 *Hz*	*******	789 €
B	iSight	66 *cm*	1920 x 1080 *pixels*	100 *Hz*	****	789 €
C	Observer	81 *cm*	1920 x 1080 *pixels*	100 *Hz*	***	899 €
D	Watcher	66 *cm*	1366 x 768 *pixels*	200 *Hz*	******	993 €
E	Eagle-Y	66 *cm*	1920 x 1080 *pixels*	100 *Hz*	*******	1099 €

Figure 2: low conflict recommendation set (LCRS)

Merk / Model		Beeldscherm	Resolutie	Frequentie	Design	Prijs
A	Iconic	66 *cm*	1366 x 768 *pixels*	100 *Hz*	*******	789 €
B	iSight	81 *cm*	1920 x 1080 *pixels*	100 *Hz*	******	899 €
C	Observer	94 *cm*	1366 x 768 *pixels*	200 *Hz*	********	975 €
D	Watcher	81 *cm*	1920 x 1080 *pixels*	200 *Hz*	*******	1099 €
E	Eagle-Y	94 *cm*	1920 x 1080 *pixels*	400 *Hz*	*********	1249 €

Figure 3: low conflict recommendation set extended with an extreme option (LCRS EXT)

Merk / Model		Beeldscherm	Resolutie	Frequentie	Design	Prijs
A	Iconic	66 *cm*	1366 x 768 *pixels*	100 *Hz*	********	789 €
B	iSight	81 *cm*	1920 x 1080 *pixels*	100 *Hz*	******	899 €
C	Observer	94 *cm*	1366 x 768 *pixels*	100 *Hz*	********	975 €
D	Watcher	81 *cm*	1920 x 1080 *pixels*	200 *Hz*	*******	1099 €
E	Eagle-Y	94 *cm*	1920 x 1080 *pixels*	400 *Hz*	*********	1249 €
F	Argentavis	81 *cm*	1920 x 1080 *pixels*	400 *Hz*	*********	1499 €

APPENDIX II: RA MODELS FOR A LAPTOP

Figure 1: high conflict recommendation set (HCRS)

Merk / Model		Beeldscherm	Opslag-capaciteit	RAM geheugen	Klok-snelheid	Design	Prijs
A	RSi 9	14,5 *inch*	320 *GB*	2 *GB*	2 *Ghz*	*******	689 €
B	Hr-Nia	14,5 *inch*	400 *GB*	2 *GB*	3 *Ghz*	****	689 €
C	CANS	15,6 *inch*	400 *GB*	3 *GB*	2 *Ghz*	***	749 €
D	Square-Y	15,6 *inch*	320 *GB*	2 *GB*	3 *Ghz*	******	899 €
E	NO-Ergo	15,6 *inch*	320 *GB*	3 *GB*	2 *Ghz*	********	999 €

Figure 2: low conflict recommendation set (LCRS)

Merk / Model		Beeldscherm	Opslagcapaciteit	RAM geheugen	Klok-snelheid	Design	Prijs
A	RSi 9	14,5 *inch*	320 *GB*	2 *GB*	2 *Ghz*	*******	689 €
B	Hr-Nia	15,6 *inch*	400 *GB*	3 *GB*	2 *Ghz*	******	749 €
C	CANS	17,3 *inch*	320 *GB*	3 *GB*	2 *Ghz*	********	865 €
D	Square-Y	15,6 *inch*	500 *GB*	2 *GB*	3 *Ghz*	*******	880 €
E	NO-Ergo	17,3 *inch*	400 *GB*	3 *GB*	3 *Ghz*	*********	999 €

Figure 3: low conflict recommendation set extended with an extreme option (LCRS EXT)

Merk / Model		Beeldscherm	Opslag-capaciteit	RAM geheugen	Klok-snelheid	Design	Prijs
A	RSi 9	14,5 *inch*	320 *GB*	2 *GB*	2 *Ghz*	*******	689 €
B	Hr-Nia	15,6 *inch*	400 *GB*	3 *GB*	2 *Ghz*	******	749 €
C	CANS	17,3 *inch*	320 *GB*	3 *GB*	2 *Ghz*	********	865 €
D	Square-Y	15,6 *inch*	500 *GB*	2 *GB*	3 *Ghz*	*******	880 €
E	NO-Ergo	17,3 *inch*	400 *GB*	3 *GB*	3 *Ghz*	*********	999 €
F	Apophis	15,6 *inch*	400 *GB*	3 *GB*	3 *Ghz*	*********	1299 €

APPENDIX III: SWITCHING OPTIONS

Figure 1: switching option for a TV

Merk / Model		Beeldscherm	Resolutie	Frequentie	Design	Prijs
X	Chimera	81 *cm*	1366 x 768 *pixels*	100 *Hz*	*******	879 €

Figure 2: switching option for a Laptop

Merk / Model		Beeldscherm	Opslag-capaciteit	RAM geheugen	Klok-snelheid	Design	Prijs
Y	Serenity	15,6 *inch*	320 *GB*	2 *GB*	2 *Ghz*	*******	750 €

APPENDIX IV: SURVEY

Beste respondent,

Voor u ligt een enquête ter ondersteuning van mijn Master Thesis. Voor een gerenommeerd bedrijf, dat voornamelijk online elektronica verkoopt onderzoek ik hoe zij haar website kan verbeteren om te zorgen dat deze beter aanluit bij de wensen van hun klanten.

De hulpmiddelen die zij online beschikbaar stellen voor klanten om naar producten te zoeken, willen zij op een andere manier integreren in hun website zodat klanten die online naar een product zoeken nog beter geholpen kunnen worden en dat ze uitkomen bij het product dat nog beter aansluit bij hun wensen. Om dit te onderzoeken heb ik uw hulp hard nodig. Wil u zo vriendelijk zijn deze enquête in te vullen.

Deze enquête bestaat uit twee delen. In het eerste gedeelte worden een aantal algemene vragen gesteld, in het tweede gedeelte worden een aantal vragen gesteld aan de hand van twee casussen. In de eerste casus maakt u een keuze voor de online aankoop van een TV, in de tweede voor een Laptop.

Het invullen gebeurt anoniem en de gegevens zullen alleen worden gebruikt voor dit onderzoek. Uw privacy is dus gewaarborgd.

Bij voorbaat dank,

Rob Peeters

DEEL 1: ALGEMENE VRAGEN

1. Wat is uw geslacht? (*gender*)
   - ☐ Man
   - ☐ Vrouw

2. Wat is uw leeftijd?

Jonger dan 25	☐
25 – 35	☐
36 – 44	☐
45 – 54	☐
55 – 64	☐
Ouder dan 64	☐

3. Koopt u producten online? (*online*)
   - ☐ Zelden
   - ☐ Soms
   - ☐ Regelmatig
   - ☐ Vaak

4. Als u een nieuw product wilt aanschaffen, maakt u dan gebruik van internet om informatie over dat product in te winnen alvorens het aan te schaffen? (*internet*)
   - ☐ Zelden
   - ☐ Soms
   - ☐ Regelmatig
   - ☐ Vaak

5. Heeft u al eens een TV (LCD, LED of Plasma) online aangeschaft? (*TV_online*)
   - ☐ Ja
   - ☐ Nee

6. Hoelang geleden heeft u deze TV online aangeschaft? (*TV_time*)
   - ☐ < 3 maanden
   - ☐ < 6 maanden
   - ☐ < 1 jaar
   - ☐ < 2 jaar
   - ☐ Meer dan 2 jaar
   - ☐ n.v.t.

7. Heeft u al eens een Laptop online aangeschaft? (*LT_online*)
   - ☐ Ja
   - ☐ Nee

8. Hoelang geleden heeft u deze Laptop online aangeschaft? (*LT_time*)
   - ☐ < 3 maanden
   - ☐ < 6 maanden
   - ☐ < 1 jaar
   - ☐ < 2 jaar
   - ☐ Meer dan 2 jaar
   - ☐ n.v.t

9. Heeft u thuis een TV (LCD, LED of Plasma)? (*TV_home*)
   - ☐ Ja
   - ☐ Nee

10. Heeft u thuis een Laptop? (*LT_home*)
    - ☐ Ja
    - ☐ Nee

De vragen **11** en **12** hebben betrekking op de eigenschappen / specificaties van het product. Bij deze vragen gaat het niet om bijvoorbeeld levertijd, betrouwbaarheid van een online winkel, garantie of dat het product op voorraad leverbaar is.

11. Ik weet heel goed op welke product-eigenschappen ik moet letten als ik een TV koop / zou kopen. (*TV_attributes*)

Helemaal mee oneens						Helemaal mee eens
○	○	○	○	○	○	○

12. Ik weet heel goed op welke product-eigenschappen ik moet letten als ik een Laptop koop / zou kopen. (*LT_attributes*)

Helemaal mee oneens						Helemaal mee eens
○	○	○	○	○	○	○

13. Met welke van de onderstaande product-eigenschappen van een TV bent u bekend mee? (*TV_know*)

Beelddiagonaal (inch/cm)	□	Reactiesnelheid (ms)	□
Full HD	□	24p	□
Frequentie (Hz)	□	DLNA	□
HDMI	□	USB	□
HD-Ready	□	Scart-ingang	□
Resolutie	□	Dynamisch Contrast	□
		Geen van allen	□

14. Met welke van de onderstaande product-eigenschappen van een Laptop bent u bekend mee? (*LT_know*)

Kloksnelheid (MHz)	□	Videokaart	□
RAM-geheugen (Mb)	□	Opslagcapaciteit (Gb)	□
Beelddiagonaal (inch/cm)	□	Webcam	□
Wireless	□	Resolutie	□
USB	□	rpm	□
Processor	□	Inch	□
		Geen van allen	□

DEEL 2

Nu volgen er twee casussen. Deze berusten op de keuze van de aanschaf van een TV en een Laptop. Merken zijn in deze casussen vervangen door fictieve merken, daarnaast kunt u aannemen dat bepaalde randvoorwaarden, die u waarschijnlijk online ook belangrijk acht, voor elk product hetzelfde zijn (bijv. levertijd, garantie, service, verzendkosten en betaalwijze). Ik wil u vriendelijk vragen dit serieus in te vullen. Dus, spoor uw rechter hersenhelft aan, waan u in een online setting en bedenk dat u echt op zoek bent naar een nieuwe TV of Laptop. In deze twee casussen bent u niet verplicht om een keuze te maken. Mocht u niet tot een keuze kunnen komen kunt u ook aangeven dat u van een keuze wil afzien. Lees de casussen aandachtig door en nogmaals bedankt voor uw moeite.

CASUS 1: NIEUWE TV

U bent op zoek naar een nieuwe TV. U gaat ervan uit dat u wel een goede TV moet kunnen vinden in de prijsklasse **700** tot **1200** euro. U heeft het geld om een duurdere TV te kopen, maar het liefst wilt u niet meer dan **1000** euro uitgeven. Geld is makkelijker uitgegeven dan verdiend tenslotte.

Naast de **prijs** van de TV vindt u de volgende eigenschappen / specificaties van een TV ook van belang:

- beeldschermgrootte
- resolutie
  - ✓ *hoe hoger de resolutie, hoe hoger de beelddichtheid. Bij een hoge beelddichtheid heeft u dus meer detail op het scherm, dus een scherper beeld. De resolutie wordt bepaald door het aantal pixels waaruit het beeld is opgebouwd*.
- frequentie
  - ✓ *meer Hz zorgt er voor de televisie minder last heeft van het zogenaamde na-ijleffect. Meer Hz levert een nog vloeiender beeld op.*
- design

U besluit online te gaan zoeken naar de TV die aan uw wensen voldoet. Al snel komt u tot de conclusie dat er heel veel verschillende TV's online worden aangeboden en heel veel product-informatie over TV's te vinden is. Om uw zoektocht naar de nieuwe TV te vergemakkelijken besluit u gebruik te maken van een Recommendation Agent. Dit is een online tool die aan de hand van de door u aangegeven preferenties een aanbeveling doet. De TV's die niet aan deze preferenties voldoen worden op deze manier gefilterd waardoor er een aantal TV's overblijven die waarschijnlijk het beste aansluiten bij uw wensen.

U wilt een TV met een minimale beeldgrootte van **66 cm** (26 inch), maar een **groter** scherm zou mooi zijn. Naast de beeldgrootte vindt u de resolutie van de TV ook belangrijk. U wilt een TV die minimaal een resolutie heeft van **1366 x 768**, echter wilt u liever een TV **met de hoogste** resolutie van **1920 x 1080**. Daarnaast wilt u een TV van minimaal **100 Hz**, maar liever **meer**.

Als laatste vindt u het **design** ook belangrijk, u zou dan ook een TV willen vinden die qua design een **hoge waardering** heeft. De hoogste waardering voor design is **10 sterren**.
De preferenties die u heeft aangegeven aan de hand van de Recommendation Agent leveren de volgende aanbevelingen op. Deze aanbevelingen zijn gesorteerd op laagste prijs.

U bent dus opzoek naar een TV met de volgende eigenschappen:

- minimale beeldschermgrootte van 66 cm
- minimale resolutie van 1366 x 768
- minimaal 100 Hz
- een hoge waardering voor design.
- prijsklasse 800 tot 1200 euro, maar liever niet meer dan 1000 euro

Let op: bent u er niet van overtuigd dat u in deze aanbevelingen een TV kan vinden, dan kunt u ook van een keuze afzien.

See Appendix I for the different recommendation sets

15. Gebaseerd op de aanbevelingen van de Recommendation Agent, welke TV zou u kiezen? (*TV_choice*)

☐ A: Iconic
☐ B: iSight
☐ C: Observer
☐ D: Watcher
☐ E: Eagle-Y
☐ F: Argentavis (Only an option in the LCRS EXT condition)
☐ Geen keuze kunnen maken, ik zie af van een TV op dit moment.

16. Het kiezen van een TV (*ook als u geen keuze heeft kunnen maken*) vond ik een moeilijke keuze. (*TV_difficult*)

Helemaal mee oneens						Helemaal mee eens
○	○	○	○	○	○	○

Heeft u bij vraag 15 geen keuze kunnen maken, dan kunt u vraag 17 beantwoorden met neutraal.

17. Ik ben er zeker van dat ik de juiste keuze heb gemaakt. (*TV_confidence*)

Helemaal mee oneens						Helemaal mee eens
○	○	○	○	○	○	○

18. Ik ben zeer tevreden over de aanbevelingen van de Recommendation Agent. (*RAS_TV*)

Helemaal mee oneens						Helemaal mee eens
○	○	○	○	○	○	○

Volgende week komt er een nieuw model in ons assortiment binnen. Misschien heeft u nog geen keuze kunnen maken of lijkt u deze TV beter dan de TV die u net heeft gekozen, dan kunt u nog van keuze veranderen. Deze TV heeft de volgende eigenschappen / specificaties:

See Appendix III for the switch option

19. Zou u deze TV willen kiezen? (*TV_switch*)

☐ Ja
☐ Nee

CASUS 2: NIEUWE LAPTOP

U bent op zoek naar een nieuwe Laptop. U gaat ervan uit dat u wel een goede Laptop moet kunnen vinden in de prijsklasse **600** tot **1000** euro. U heeft het geld om een duurdere Laptop van te kopen, maar het liefst wilt u niet meer dan **900** euro uitgeven. Geld is makkelijker uitgegeven dan verdiend tenslotte.

Naast de **prijs** van de Laptop vindt u de volgende eigenschappen van een Laptop ook van belang:

- beeldschermgrootte (inch)
- opslagcapaciteit (GB)
  - ✓ *Het belangrijkste kenmerk van een harde schijf is de opslagcapaciteit. Deze wordt uitgedrukt in gigabyte (GB). Hoe meer GB, hoe meer er op de harde schijf kan.*
- kloksnelheid (Ghz)
  - ✓ *De kloksnelheid van een processor is het aantal bewerkingen dat een processor per seconde kan uitvoeren. Dit heeft invloed op de snelheid van het systeem.*
- interne / RAM geheugen (GB)
  - ✓ *Naast de processor is het intern geheugen van invloed op de prestaties van je laptop. Het intern geheugen wordt ook wel Read Access Memory (RAM) genoemd. Hoe groter het intern geheugen, hoe beter en sneller de laptop overweg kan met toepassingen en hoe meer programma's je tegelijkertijd open kunt laten staan.*
- design

U besluit online te gaan zoeken naar de Laptop die aan uw wensen voldoet. Al snel komt u tot de conclusie dat er heel veel verschillende Laptops online worden aangeboden en heel veel product-informatie over Laptops te vinden is. Om uw zoektocht naar de nieuwe Laptop te vergemakkelijken besluit u gebruik te maken van een Recommendation Agent. Dit is een online tool die aan de hand van de door u aangegeven preferenties een aanbeveling doet. De Laptops die niet aan deze preferenties voldoen worden op deze manier gefilterd waardoor er een aantal Laptops overblijven die waarschijnlijk het beste aansluiten bij uw wensen.
U wilt een Laptop met een minimale beeldgrootte van **14,5 inch**, maar u prefereert een groter scherm. Naast de beeldgrootte wilt u een opslagcapaciteit van minimaal **320 GB**. Daarnaast wilt u een Laptop met minimaal **2 GB RAM** geheugen en een kloksnelheid van minimaal **2 Ghz**, maar nog **meer** geheugen en sneller zou mooi zijn.
Als laatste vindt u het **design** ook belangrijk, u zou dan ook een Laptop willen vinden die qua design een hoge waardering heeft. De hoogste waardering voor design is **10 sterren**.

De preferenties die u heeft aangegeven aan de hand van de Recommendation Agent leveren de volgende aanbevelingen op. Deze aanbevelingen zijn gesorteerd op laagste prijs.

U bent dus opzoek naar een Laptop met de volgende eigenschappen:

- minimale beeldschermgrootte van 14,5 inch
- minimaal 320 GB opslagcapaciteit
- minimaal 2 GB RAM geheugen
- minimaal 2 Ghz kloksnelheid
- een hoge waardering voor design
- prijsklasse 600 tot 1000 euro, maar liever niet meer dan 900 euro

Let op: bent u er niet van overtuigd dat u in deze aanbevelingen een Laptop kan vinden, dan kunt u ook van een keuze afzien.

See Appendix II for the different recommendation sets

20. Gebaseerd op de aanbevelingen van de Recommendation Agent, welke Laptop zou u kiezen? (*LT_choice*)

☐ A: RSi 9
☐ B: HR-Nia
☐ C: CANS
☐ D: Square-Y
☐ E: NO-Ergo
☐ F: Apophis (Only an option in the LCRS EXT condition)
☐ Geen keuze kunnen maken, ik zie af van een Laptop op dit moment.

21. Het kiezen van een Laptop (*ook als u geen keuze heeft kunnen maken*) vond ik een moeilijke keuze. (*LT_difficult*)

Helemaal mee oneens						Helemaal mee eens
○	○	○	○	○	○	○

Heeft u bij vraag 20 geen keuze kunnen maken, dan kunt u vraag 22 beantwoorden met neutraal.

22. Ik ben er zeker van dat ik de juiste keuze heb gemaakt. (*LT_confidence*)

Helemaal mee oneens						Helemaal mee eens
○	○	○	○	○	○	○

23. Ik ben zeer tevreden over de aanbevelingen van de Recommendation Agent. (*RAS_LT*)

Helemaal mee oneens						Helemaal mee eens
○	○	○	○	○	○	○

Volgende week komt er een nieuw model in ons assortiment binnen. Misschien heeft u nog geen keuze kunnen maken of lijkt u deze Laptop beter dan de Laptop die u net heeft gekozen, dan kunt u nog van keuze veranderen. Deze Laptop heeft de volgende eigenschappen / specificaties:

See Appendix III for the switch option

24. Zou u deze Laptop willen kiezen? (*LT_switch*)
    - ☐ Ja
    - ☐ Nee

APPENDIX V: SAMPLE DISTRIBUTION

Figure 5.1: number of subjects for each condition differentiated to gender

		Condition			
		HCRS	LCRS	LCRS-EXT	Total
Gender	Man	37	36	32	105
	Vrouw	36	23	22	81
Total		73	59	54	186

Figure 5.2: number of subjects for each condition differentiated to age

		Condition			
		HCRS	LCRS	LCRS-EXT	Total
Age	Jonger dan 25	10	7	5	22
	25 – 35	30	23	18	71
	36 – 44	13	7	10	30
	45 – 54	9	9	9	27
	55 – 64	10	12	8	30
	Ouder dan 64	1	1	4	6
Total		73	59	54	186

APPENDIX VI: DATA CLEANING

Figure 6.1: frequency table of consumers who ever bought a TV online

	TV online			
	Frequency	Percent	Valid Percent	Cumulative Percent
No	169	90,9	90,9	90,9
Yes	17	9,1	9,1	100,0
Total	186	100,0	100,0	

Figure 6.2: frequency table of how long ago a consumer had purchased their TV online

	TV time			
	Frequency	Percent	Valid Percent	Cumulative Percent
N/a	167	89,8	89,8	89,8

Figure 6.3: frequency table of consumers who ever bought a LT online

	LT online			
	Frequency	Percent	Valid Percent	Cumulative Percent
No	148	79,6	79,6	79,7
Yes	38	20,4	20,4	100,0
Total	186	100,0	100,0	

Figure 6.4: frequency table of how long ago a consumer had purchased their LT online

	LT time			
	Frequency	Percent	Valid Percent	Cumulative Percent
N/a	146	78,5	78,5	78,5

Figure 6.5: scatterplot of decision time before data cleaning

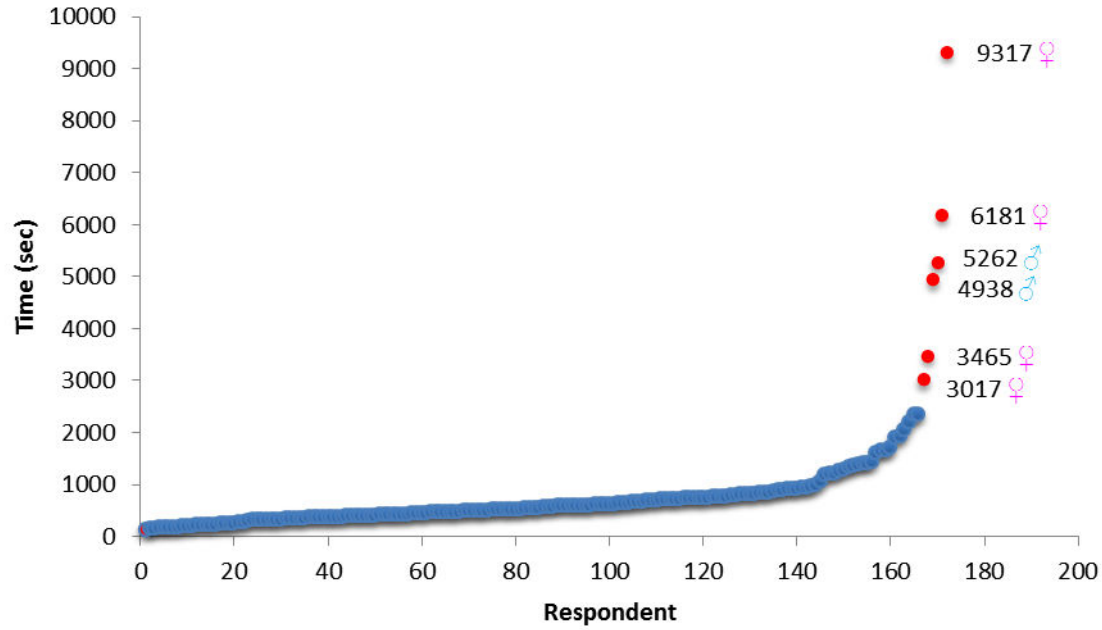


Figure 6.6: histogram of decision time before data cleaning

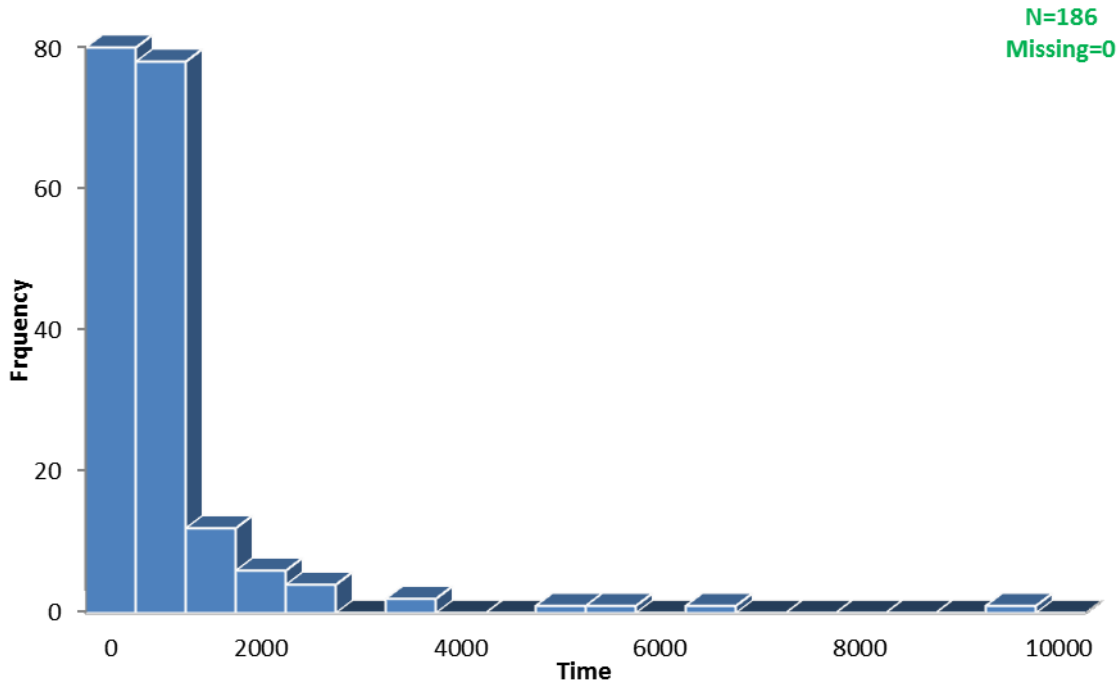


Figure 6.7: histogram of decision time after cleaning the outliers

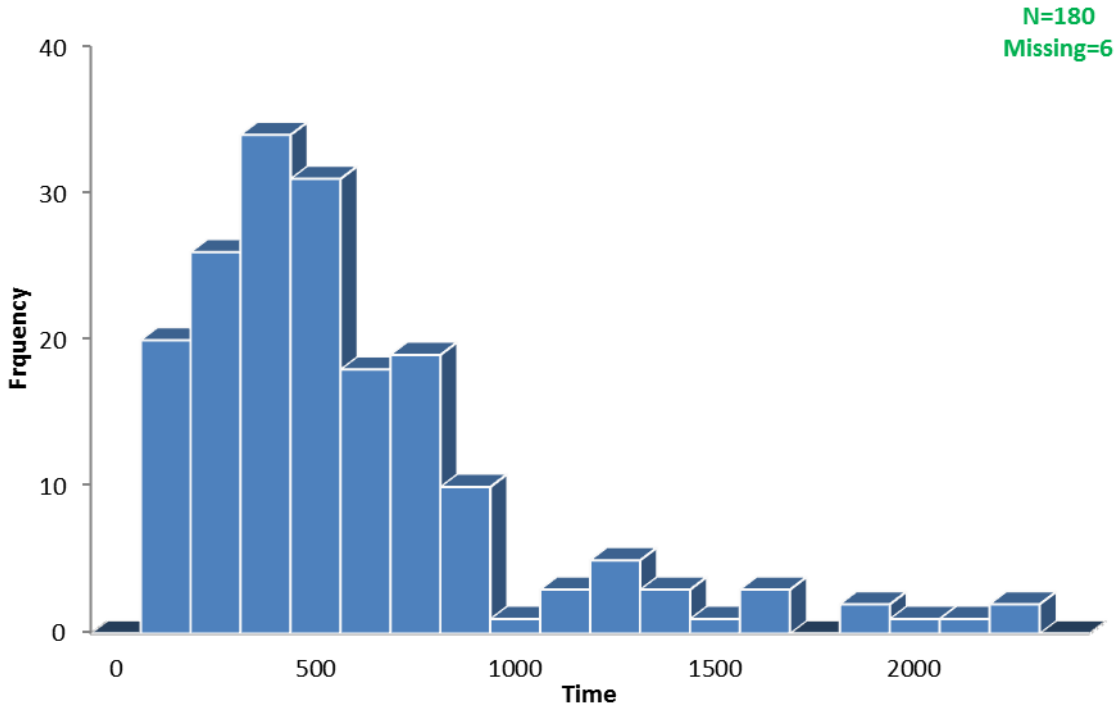
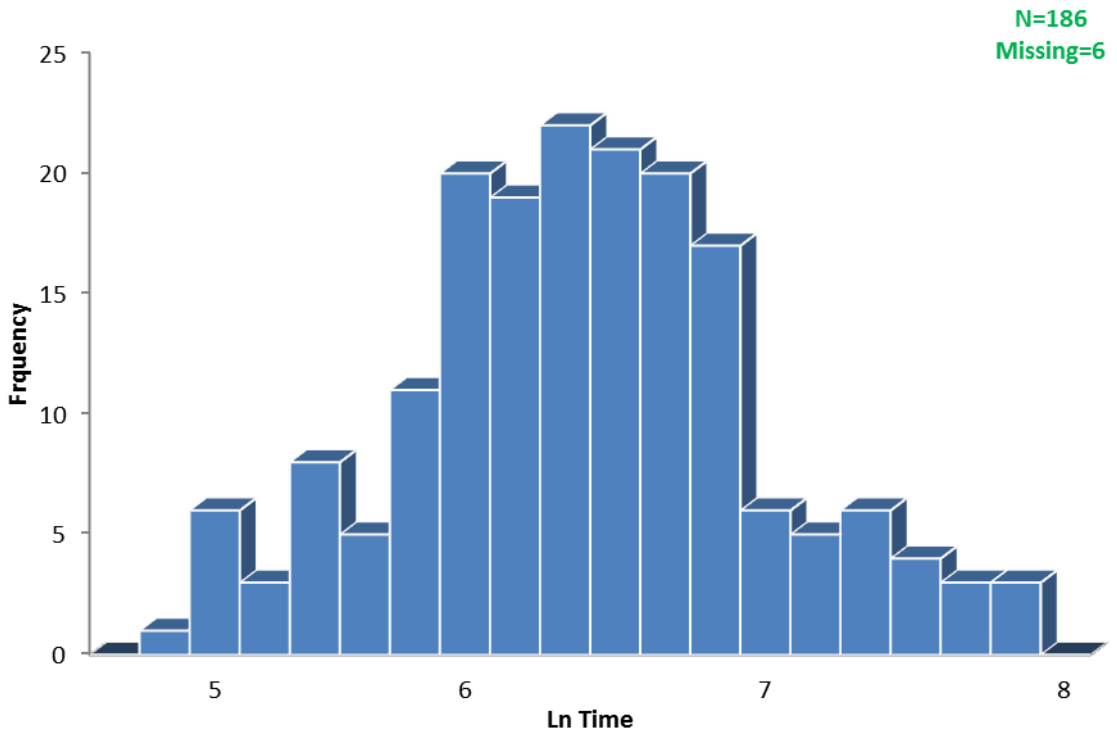


Figure 6.8: histogram natural logarithm decision time after cleaning the outliers



APPENDIX VII: ADDITIONAL INFORMATION

Figure 7.1: percent of consumers that buy products online

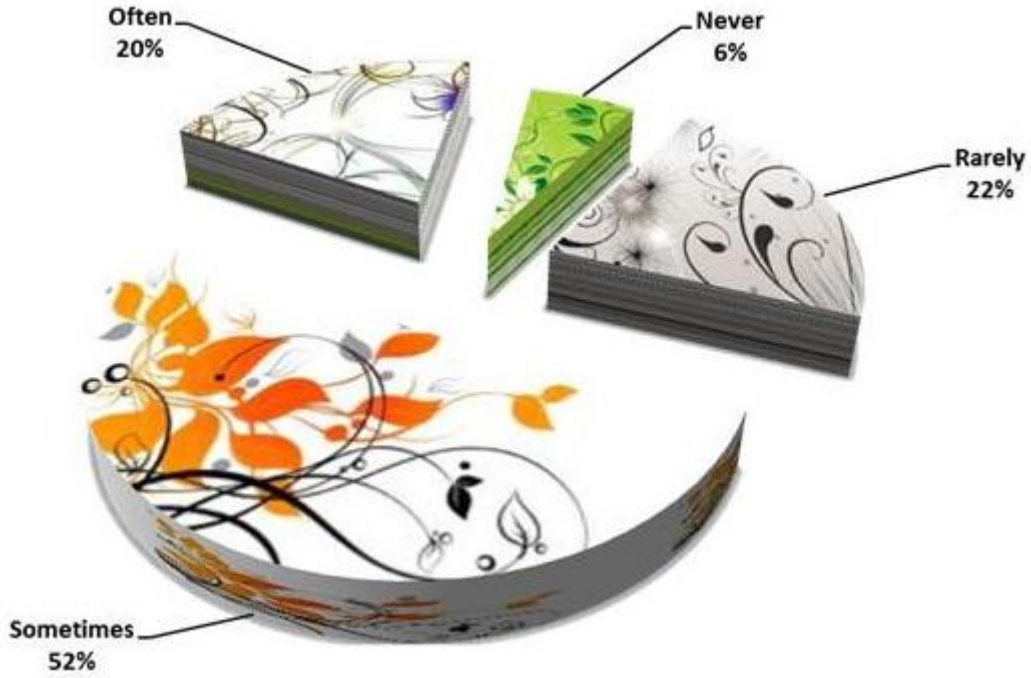


Figure 7.2: percent of consumers that use the internet to acquire product information prior to purchasing a product

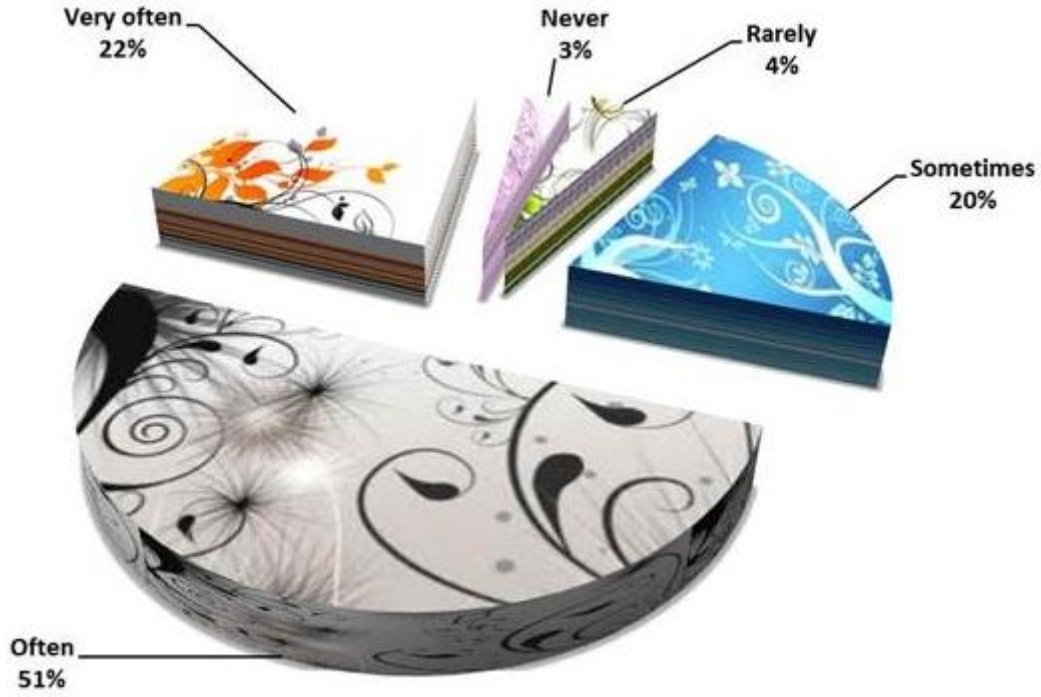


Figure 7.3: line chart of the product counts for TV in a LCRS and a LCRS EXT

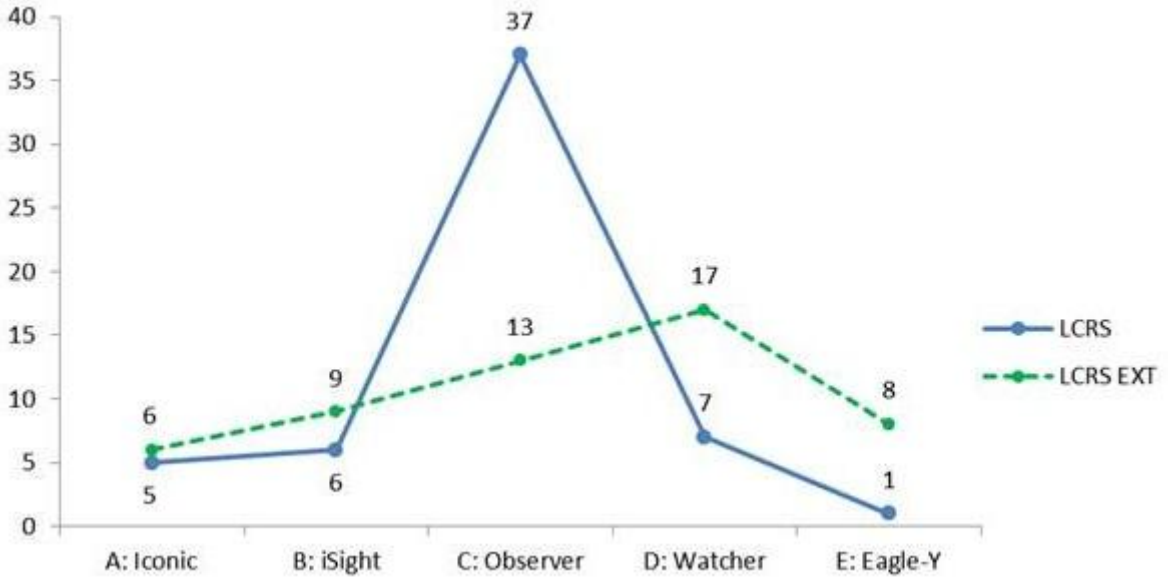


Figure 7.4: line chart of the product counts for Laptop in a LCRS and a LCRS EXT

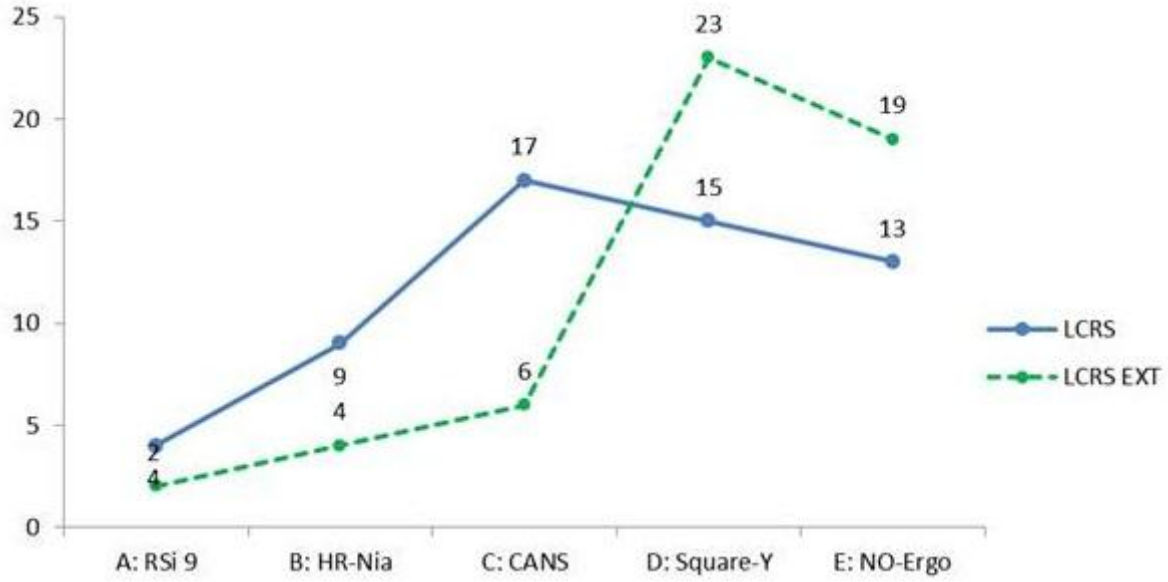


Figure 7.5: line chart of the mean price for TV and Laptop in a LCRS and a LCRS EXT

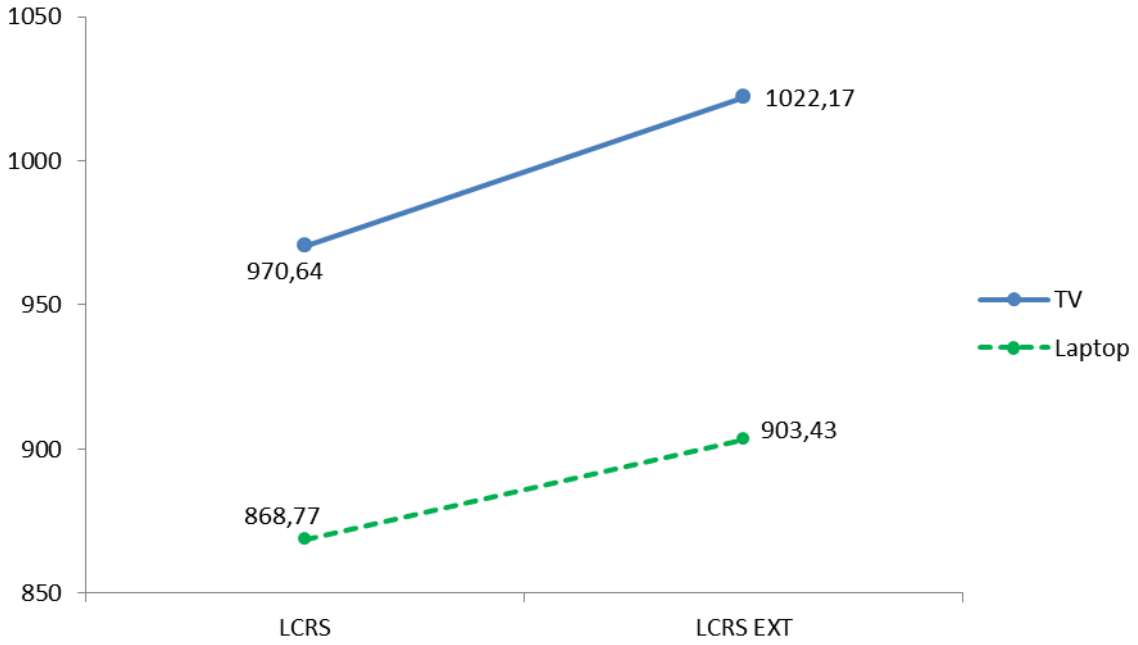


Figure 7.6: line chart of the means of difficulty for TV and Laptop under different conditions

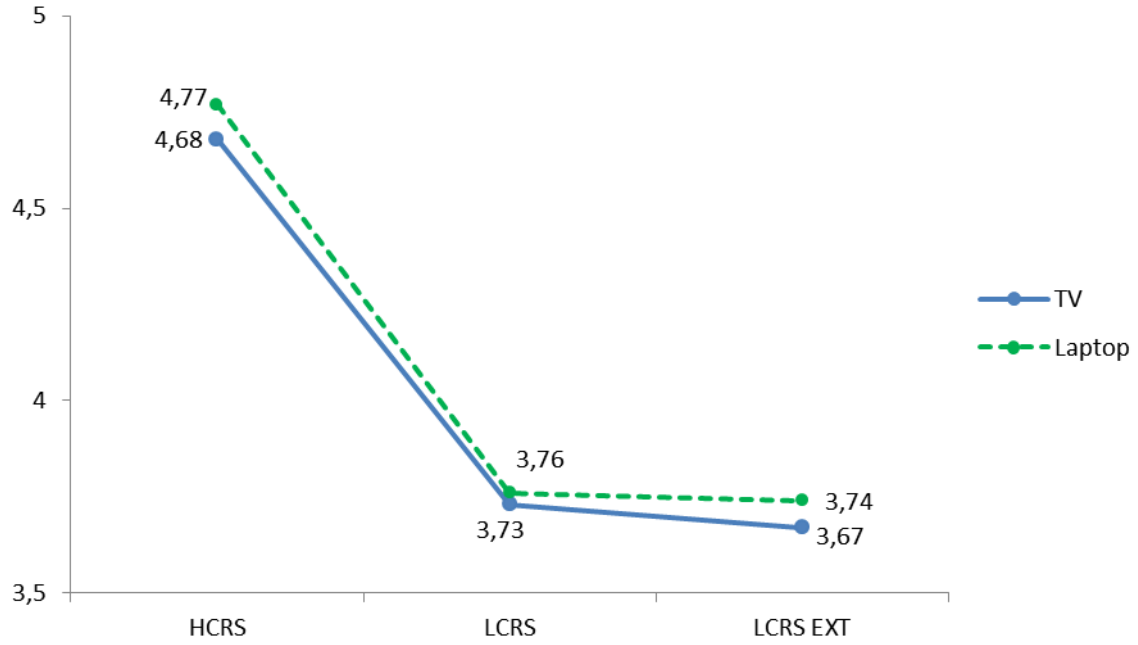


Figure 7.7: line chart of the means of confidence for TV and Laptop under different conditions

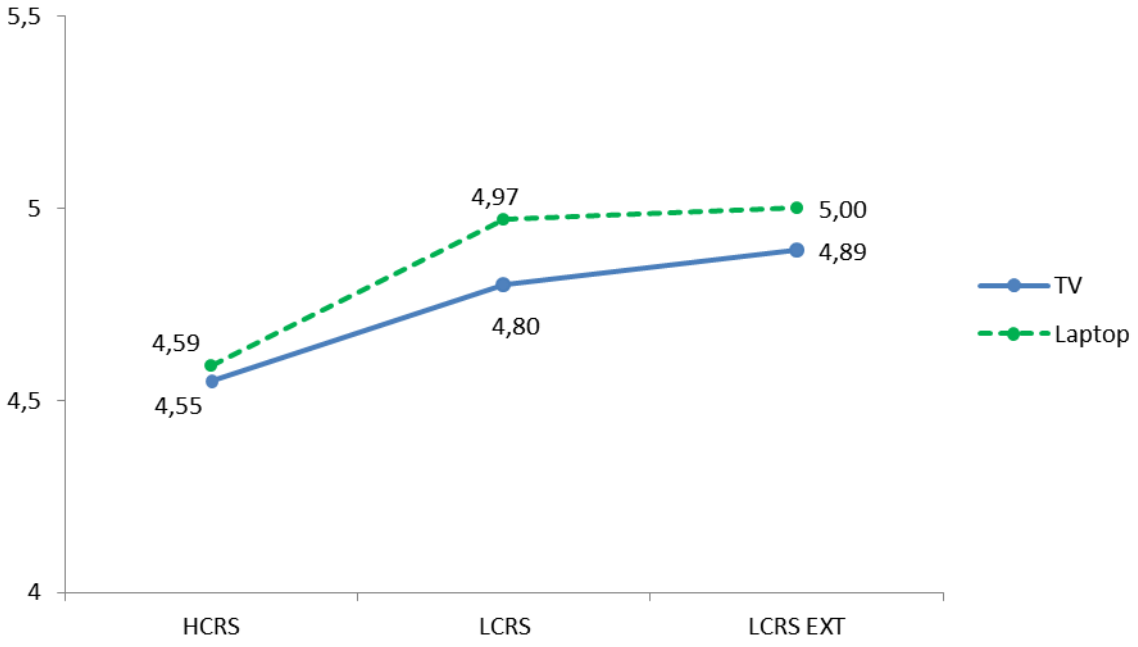


Figure 7.8: line chart of the means of satisfaction for TV and Laptop under different conditions