Master Thesis

Improving the e-sales dialog for complex products

Colophon

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Abstract

With the expanding of the internet, so did electronic commerce grow. Most of the people already buy products like books and movies on the Internet, but more complex products like computers, kitchens and cars stay behind in sales. One of the reasons is that most sites operate via a menu-driven navigation and keyword search, which are hard to use. Customers are confronted with technical jargon which they are not able to understand, or are subjected to annoying or irrelevant questions. Online customers want the same personalized advice and product offerings like their off-line counterparts.

The goal of this thesis is to explore how to improve online e-sales, especially for complex products, in order to increase the number of sales, and therefore expand the market. Prior to creating a model for the improvement of e-sales dialogs, current techniques that can be used to improve the current e-sales dialog are discussed. Then complex products are defined and a small case will be presented to see how Dell handles his online sales. To get an indication how customers deal with online sales, a small market research will be performed. This market research will address the strong and weak points of the current way products are sold online.
Following out of the market research a user model will be presented. This user model will be used to create a model for the dialog manager. This model aims to improve the e-sales dialog by supporting the customer in the buying process through adaptive interaction, being able to understand what the needs are of the customer. Finally, a proof of concept will be used to proof the validity of this model.

Keywords: *online sales, economic feasibility, e-sales dialogs, information need level, fuzzy logic, case-based reasoning, noncooperative dialogs, user models, complex products, classifying complex products, Dell, market research*

Preface

This thesis is written for my Master of Science in Computer Science at the Radboud University of Nijmegen. I worked with the department Information Retrieval & Information System (IRIS) on my thesis with as subject “Improving the e-sales dialog for complex products”.
Since I followed the management master of the study, I tried to incorporate this aspect into my thesis.
The thesis is based on recent literature to get an image of how e-sales dialogs currently are used, and what techniques are used. I also used examples from real e-sales stores to see how the current situation is. This information combined with a customer research will hopefully lead to an improved model for the e-sales dialog.

I would like to thank Theo van der Weide from IRIS and Ben Dankbaar from Management Research for their supervision and support. Additionally, there are several other people that have helped me, ranging from discussing the research to providing moral support. I would like to thank those people too.

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1 Introduction

With the expanding of the internet, so did electronic commerce grow. Most of the people already buy products like books and movies on the Internet. But more complex products like computers, kitchens and cars stay behind in sales. One of the reasons is that most sites operate via a menu-driven navigation and keyword search, which are hard to use. Customers are confronted with technical jargon which they are not able to understand, or are subjected to annoying or irrelevant questions. Online customers want the same personalized advice and product offerings like their off-line counterparts. The goal of this thesis is to explore how to improve online e-sales dialogs, especially for complex products, in order to increase the number of sales, and therefore expand the market for online sales. This will be done by creating and validating a model for the e-sales dialog.

The target group of the thesis are online stores, which can use or improve their dialogs to increase sales. The dialog targets customers that don't exactly know what product they want, but they do have a need to fulfil. This can also be expressed as the so called visceral need level, which literally means: A vague sense of dissatisfaction, due to an actual, but unexpressed need for information (Taylor, 1968). Which in the context of this thesis means, that the customer does have a need for a product, but he can't give a detailed description of the product that would fulfil that need. The ultimate goal of a sales dialog is to find a product for a customer such that his demands are fulfilled and he is willing to buy the product. However, many online e-sales sites do not provide interactive sales support. This is even more problematic when the product sold is complex, for example computers (Schmitt, 2002). A key role is to retrieve the requirements of the customer (Bergmann & Cunningham, 2002). The goal is to mimic real life sales processes via an online agent. The goal of this online agent is to make a customer adaptive sales dialog. This can be done with techniques like case-based reasoning (Kohlmaier, Schmitt, & Bergmann, 2001). In general, when a user is confronted with a static dialog, this dialog is unnecessarily long, asks the wrong questions, and can annoy the user. The dialog should instead maximize its information gain with each question it asks, and find the product that satisfies the customer's demands in the least questions necessary.

1.1 Motivation

I am a frequent user of e-sales, because it's more efficient and cheaper than the real life variant. It always intrigued me why online sales dialogs are always so static, and usually nothing more than paper tables formatted into a webpage. As a result that I only use online shopping for simple products e.g. books and movies or for complex products I have knowledge of e.g. computers. But for other complex products like digital cameras I use other resources of information to decide which product to buy. As a result I will go to an offline store for information, and this also increases the chance I will buy the product there. Resulting in less commerce for e-businesses. I find it interesting to explore how we can improve online sales dialogs, using computer science techniques. It also relates to Artificial Intelligence, which is also a field of interest for me. I find it interesting to see how well a virtual agent could emulate a real dialog. And it also has a significant market aspect, if sites would be more user friendly, they would sell the right product to the right people. This can increase their reputation and therefore their sales, having serious effects on e-sales in the future.

1.2 Goal

The goal of the thesis is to explore how we can improve the e-sales dialog for complex products. To reach this goal, I will investigate in my thesis what the demands would be for a successful e-sales dialog for complex products. This results in the following main question:

1.2.1 Main Question

What are the demands a successful e-sales dialog for complex products should meet?

To be able to answer this question, we need to define the elements in the question. A *dialog* is defined according to the Merriam-Webster dictionary (http://www.m-w.com/dictionary) as:

1. written composition in which two or more characters are represented as conversing
2. **a.** conversation between two or more persons; also : a similar exchange between a person and something else (as a computer)
   b. exchange of ideas and opinions <organized a series of dialogues on human rights>
   c. discussion between representatives of parties to a conflict that is aimed at resolution <a constructive dialogue between loggers and environmentalists>
3. conversational element of literary or dramatic composition <very little dialogue[1] in this film>
4. musical composition for two or more parts suggestive of a conversation

For the scope of this thesis, it is clearly that definition **2.a.** describes the dialog used in the question. A sales dialog is then defined as a conversation between a person and a website, where the person is the customer and the website the seller. The goal of the sales dialog is to transfer ownership of a product, selling a product. It does this by getting information from the customer, and uses that information to select a small number of products to offer to the customer. The dialog should combine the benefits of online and offline shopping. This means it should use direct feedback and guidance of the customer which come from the offline shopping, and the ability to store and retrieve vast amounts of data which comes from the online shopping.

The definition of *complex products* is somewhat harder. Complex can be defined as:

1. composed of many interconnected parts; compound; composite: a complex highway system.
2. characterized by a very complicated or involved arrangement of parts, units, etc.: complex machinery.
3. so complicated or intricate as to be hard to understand or deal with: a complex problem.
4. grammar.
   a. (of a word) consisting of two parts, at least one of which is a bound form, as childish, which consists of the word child and the bound form -ish.
   b. complex sentence.
5. mathematics. Pertaining to or using complex numbers: complex methods; complex vector space.

Definition **1.**, **2.** and **3.** all apply to this thesis. A complex product is a product which is difficult to use or difficult to buy. The usage can be difficult because it is a complicated device in the arrangement of parts and units and the arrangement of those parts and units. So it is hard to operate without any background knowledge. The buying process can be difficult because it is hard for the customer to assess the properties to which the product should comply. This means that the customer has problems assessing which internal properties will result in his desired external properties, e.g. which amount of memory (internal property) in a computer will result in a smoothly operating (external property) computer. Also it can be hard for the customer to know for sure if they have assessed all

[1] The word 'dialogue' is used here to indicate real life conversations, while 'dialog' is used for a conversation between a person and computer

important features. For example, when buying a kitchen, the customer might have determined what certain features should be, e.g. the colour, the number of cabinets. But the feature addressing the height of the kitchen sink is forgotten. This means the product is so complex, that it is hard for the customer to address all vital features.

Successful is defined as achieving or having achieved success. For the dialog to be successful, it has to be a success for the agent and the client. The agent in this case is the website owner. The client is the customer who wishes to purchase the product.
For the agent a successful sales dialog should have the following requirements:

- cover the expenses
- earlier market acceptance than using a normal website
- higher market penetration than using a normal website
- higher sales than using a normal website

For the client a successful sales dialog should have the following requirements:

- correct advise
- doesn't annoy, by asking "stupid" questions or taking too much time

To be able to answer the main question, I divided the thesis in phases, each phase is dedicated to its own question.

1.2.2 Partial Questions

- What are the current techniques available for sales dialogs?
- Which are popular products to be sold in e-commerce?
- Which models are there to represent complex products?
- What do customers deem important for online shopping?
- Which models are there to represent customers that shop online?
- Can there be a model created for the dialog manager that improve the e-sales dialog?
- Which techniques exist to prove the model?

1.3 Approach

For the thesis I divided the research in different phases. In each phase a part of the problem is assessed and worked out.

1.3.1 An overview of the current technology

I will start to make an overview of the current technology. This chapter will discuss techniques from literature compared to real life examples currently used on the internet. The techniques I will be focusing on are fuzzy reasoning (Popp & Lödel, 1995), case-based reasoning (Bergmann, Schmitt, & Stahl, 2002) (Schmitt, 2002), user models (Wahlster & Kobsa, 1989) (Vrieze, 2006), non-cooperative dialogs (Jameson, et al., 1994) and informal techniques. I have chosen for these techniques because they are upcoming and promising techniques, which can aid in the communication from the website to the customer, and improve the overall dialog. Most of these techniques aren't in widespread use yet. Also most techniques aren't linked to the selling of complex products. Therefore I would like to see, how much they can aid in improving the sales dialog for complex products. So there is a technological gap between techniques currently used and techniques mentioned in literature.

1.3.2 Complex product sales in a digital environment

In this chapter I will discuss complex products. Focussing on the digital environment, the goal is to see if it's possible to adapt a solution from the simple products to the more complex products. Complex products would be for example personal computers and digital SLR camera's. Products where users have a hard time rating certain features. Take a computer, how does a user judge if he needs 1024 MB, or 2048 MB of memory if he doesn't have a close understanding of the workings of a computer. This is much more complex to judging whether a person wants to read a horror or sci-fi book.

This thesis will focus on computers as complex products, because of the commonness of the product, and the high technical properties. It should be mentioned that not all complex products seem to be destined to be sold via the Internet. For cars there doesn't seem to be any online market. This could have something to do with the price and product characteristics involved. A product characteristic of cars is the fact that customers want to make a test drive before buying the car. This function Internet can never replace. Many high investment products, e.g. cars, houses, boats, show a low market for online sales. Whereas medium priced products like computers, laptops, cameras show a much larger market online. The computer is successfully sold via different distribution channels, and direct sales towards the end-user via the Internet are getting increasing popular (Dedrick & Kraemer, 2007). Dell is a good example of an online computer vendor with huge success. I will look closely what the strong and weak points of Dell's strategy are.

1.3.3 Economic feasibility

In this thesis, next to the technical aspect, the economic feasibility will play a vital role. Therefore, not only the technical properties, but also at the economic properties will be discussed. The goal of this approach is to come up with answers, which are not only technicall, but also economically feasible.

Moreover, there will be a case study about Dell, focussing on how Dell became such a large player in online computer sales. But also to find out why Dell has falling profit margins, and is even planning to open offline stores.

Next to the casus I will perform a limited market research. The market research will only focus on one group of customers, which will be interviewed via a number of questions relating to e-sales. The goal of this market research is to find out if under what conditions customers that currently still buy offline, can be persuaded to buy online. This is discussed in greater detail in the next paragraph.

1.3.4 Market Research

This phase focuses on the customers, instead of the products itself. Important questions in this phase are how to customers "prepare" themselves when buying products. For example, do customers take the advice of the salesmen, or do they have a fixed product in mind? Would it give problems if we try to take that online? Does an offline store have a certain added value over an online store? How can we use the possibilities of an online store to make added value over an offline store? And does this have influence on when the clients will switch? These questions are important when looking at the economic feasibility of online sales. The limited market research will help to get insight into these questions. The findings of the market research then can be compared with findings from the literature.

The respondent group used in the research will be the regular customers, which either buy online or offline, or both. This group consists of a varied people, 12-60 years old, male and female, technology enthusiasts and technology pragmatics. The questionnaire will exist of open and multiple choice questions. The multiple choice questions make it easier to statically analyse the data, while the open questions provide in depth information. The questions will address the opinions of the buyers about buying online, their experiences with it, which kind of products they buy and what needs to be improved.

I am aware that the respondent group is limited, but it will none the less give insight in why people don't buy a complex product (the computer) online, and how we can improve this.

1.3.5 Validation of the model

The goal of the thesis is to create a model which uses the techniques discussed in the previous chapters. These techniques should contribute to improving the e-sales dialog for complex products.

It has to be proven that the model covers the real life examples adequately. This validation will be done by testing it on a small user base, to see if the model can perform as described above. Secondly it also has to be economically validated.

The goal of the model is to increase the number of e-sales for complex products. To see if the model can accomplish this, I will do a limited market research, like stated above.

What is also important is to measure the satisfaction of users (Giese & Cote, 2000). Since there is no real-life feedback, other ways of feedback will be used, like the ability to give feedback online.

The thesis will address what the demands are that a successful e-sales dialog should meet. To see what these demands are, the thesis will be divided into different phases. The first phase will be discussed in the next chapter, it will look into the current techniques available for e-sales dialog, and see how they can contribute.

2 Current Techniques

The e-sales dialog is a sales dialog on the web. The goal is the same as is offline counterpart, to find the right product for the customer so it can be sold. This can be achieved via good communication between the e-sales dialog and the customer. Such a communication should be similar to communication with a real sales agent in a real store: the agent must ask appropriate questions concerning the customer's product requirements and should at a some point provide useful product information (Bergmann & Cunningham, 2002).

However, current sales dialogs on the web are usually nothing more than a digital version of their paper counterparts. Certainly when it comes to complex products, online sales are still far behind store sales. What shows is that complex products like cars, are offered online, but the actual sale is made offline. Although it is claimed that 54% of the people that buy a car do this in conjunction with the Internet, only a small portion of that really buys the car online. Most people use the Web for explorative purposes.

To be able to improve the e-sales dialog for complex products, we will first look to current techniques. We will discuss techniques which add value to the sales dialog. First we will introduce them, and explain what the technique is, then we will discuss what the benefits are for the sales dialog.

2.1 Fuzzy Reasoning

At the point of sale, there can be uncertainty and fuzziness. Consider the following example sentences from a sales conversation in which peripherals of personal computers are to be sold (Popp & Lödel, 1995):

1. *The hard disk will not break down during the first year.*
   This sentence is crisp and certain.
2. *The probability that the hard disk will not break down during the first year is 0.9.*
   This sentence is probabilistic; the probability is based on empirical data.
3. *The plausibility interval for the hypothesis that the hard disk will not break down during the first year is determined by a belief of 0.05 as the lower bound and a plausibility of 0.95 as the upper bound.*
   This sentence refers to a plausibility interval which consists of the plausibility as the upper bound and the degree of belief as the lower bound. The plausibility is the degree to which the hypothesis can be maintained without contradiction. The degree of belief reflects the amount of evidence that speaks directly for the hypothesis. The probability lies between the plausibility and the degree of belief.
4. *The possibility that the hard disk will not break down during the first year is 0.99.*
   The possibility expresses the compatibility of an event with subjective ideas, rather than the frequency of the event as in the case of probability. The statement "the event 'does not break down during the first year' is possible" is the weakest statement that can be made about the realization of the event.
5. *The time for which the hard disk will function properly is long.*
   This example contains the fuzzy term long, which means about 2 years in the context of a hard disk's life cycle. We mentioned before that the sales situation is characterized by several goals which often contradict each other, and by the use of fuzzy terms. This claim is supported by market research of Optische Werke G. Rodenstock, a company that produces eyeglasses. According to their study, consumers prefer eyeglasses which fit well (81%) and look good (60%), and which are light (55%), sturdy (51%), cheap (34%), trendy (33%), etc. Besides the linguistic fuzziness of such terms, further fuzziness results from the difference between the implemented user model and the buyer's mental model. The buyer is able to define individual requirements in some detail. However, the integration of individual requirements into a complete requirements

profile can lead to distortions since the customer does not know the exact relations and data dimensions of the product database. Thus the requirements profile represents attitudes and expectations derived from a subjective body of knowledge. Another feature typical of fuzzy techniques is the ability to present not only products which fit the requirements profile exactly but also similar and neighbouring products.

6. *The hard will not break down during the first year.*
   The last type of uncertainty results from incomplete and distorted knowledge. It is possible to infer from the context that the word disk is missing.

To be able to cope with these uncertainties, we need to see the difference between logic from humans and computers. Humans don't use the same kind of logic as computers, humans use soft computing (Zadeh, 1994). Soft computing differs from conventional (hard) computing in that is tolerant of imprecision, uncertainty and partial truth. One of the approaches to soft computing is fuzzy logic. Fuzzy logic implies that it deals with reasoning that is approximate, rather than precise.
For example, figure 1 shows the diagram of an thermostat. The diagram shows several degrees of functions, needed to control the thermostat properly. Each function has a truth value between 0 and 1. The higher the truth value, the better the function is applied. For example, the higher the truth value for cold, the more "cold" the temperature is. These truth values can be used to control the thermostat.

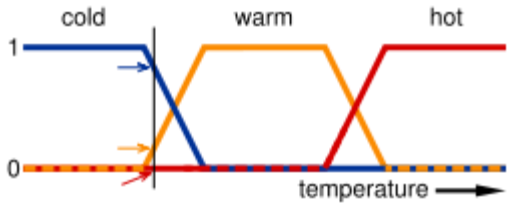

Figure 1. Example fuzzy logic

In this image, cold, warm, and hot are functions mapping a temperature scale. A point on that scale has three "truth values", one for each of the three functions. For the particular temperature shown, the three truth values could be interpreted as describing the temperature as, "fairly cold", "slightly warm", and "not hot".

The AND, OR and NOT operator of Boolean logic exist in fuzzy logic, usually defined as minimum, maximum and complement.
For fuzzy variables x and y:

$$NOT\ x = \big(1 - truth(x)\big)$$
$$x\ AND\ y = minimum\big(truth(x), truth(y)\big)$$
$$x\ OR\ y = maximum\big(truth(x), truth(y)\big)$$

Where

$$truth(x) = the\ truth\ value\ of\ x$$

In binary logic $truth(x)$ can only be 0 or 1. But in fuzzy logic the value is in $[0,1]$.
For example, using the previous figure, $cold\ AND\ warm$ would result in this diagram:

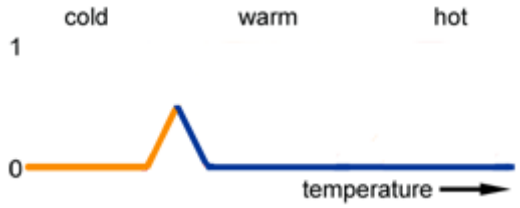

Figure 2. Example fuzzy AND operator

These operators can be used to deduct relevant properties. For example, when buying a computer, the CPU speed is a property that needs to be decided. How higher the CPU speed, the more expensive the computer, so CPU speed should be tuned the usage of the computer. When the computer is only used for text processing, a relative low amount of CPU speed is needed. But for gaming more power is needed, and for 3d designing you need the most CPU speed. The next figure shows the three example types of usage for a computer: text processing (blue), gaming (yellow), 3d & CAD design (red). 1 means the CPU speed is sufficient for that usage, while 0 means the CPU speed is too low for that usage. The higher the value, the more sufficient the CPU speed will be.

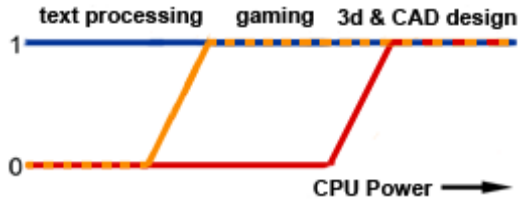

Figure 3. CPU speed example

If for example the sales dialog get the following results:

1. The customer want to use the computer primarily for text processing
2. The customer want to play some games, but not the most demanding ones
3. The customer doesn't use 3d or CAD design programs

The goal is to find the right CPU speed, which is sufficient for these goals, but keep it as low as possible to keep the costs low. Since the user wants to use the computer primarily for text processing we will keep that the truth of text processing on 1.
The customer says he wants to play *some* games. *Some* is an excellent example of an fuzzy variable, we will translate *some* for this example to a truth value of 0.5.
The customer indicates he doesn't need to use high end applications like 3d & CAD design. So this variable will have a truth value of 0.

Looking at the diagram in figure 3, we look for the spot where text processing =1.0, gaming = 0.5 and 3d & CAD design = 0.0. Figure 4 shows the point where it matches. Via this point the CPU speed can be derived.

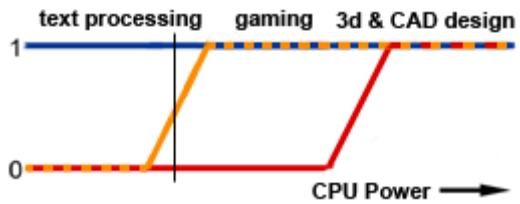

Figure 4. Estimating CPU speed via fuzzy logic

Being able to reason with abstract and uncertain answers, especially when interacting with humans, can really improve the sales dialog.

2.2 Case-based Reasoning

Case-based reasoning (CBR) is in short the process of solving new problems based on the solutions of similar past problems. The key assumption is that if two problems are similar then their solutions are probably also similar (Bergmann, Schmitt, & Stahl, 2002). For example: a student who solves a mathematical problem by recalling a previous problem which had the same elements is using case-based reasoning. Case-based reasoning is not only a powerful method for computer reasoning, but also a pervasive behaviour in everyday human problem solving. Or, to put it more radically, that all reasoning is based on past cases we have experienced.

2.2.1 The CBR process

Like stated above, the basic idea of CBR is to solve new problems by comparing them to problems already solved. CBR systems are based on some measure of this similarity (Vollrath, Wilke, & Bergmann, 1998). Old problems and their solutions are stored in a database of cases, the case base. When a new problem has to be solved, the CBR system searches for the old problem that is most similar. The solution to this old problem can be adapted to more precisely meet the requirements of the new problem. Figure 5 shows the steps of a case-based reasoning system. One of the strengths of CBR is its resemblance to the way humans tend to solve problems: by thinking in terms of similarities and preferences. These concepts often can be directly mapped to similarity measures as they are used in CBR.

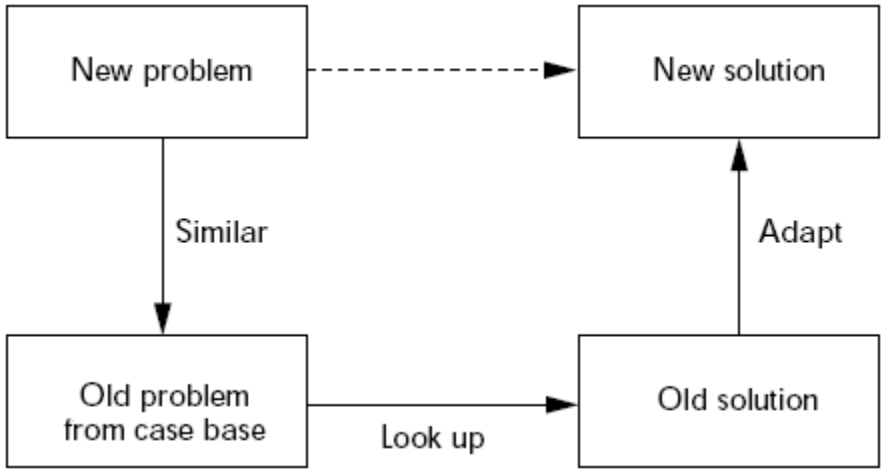

Figure 5. Case-based reasoning process

2.2.2 Using CBR for sales dialogs

For applying CBR to sales dialogs, the cases are descriptions of products. The problem description in a case is a specification of a single product and possible demands the product can satisfy. The solution to the problem is an unambiguous reference to the product. Complex products such as computers and automobiles are usually configurable, then the solution is not a product, but the entire configuration of that product.

There are different kinds of dialogs. Schmitt (2002) distinguish two major classes:

1. Predefined static dialogs: The dialog interactions and strategies are modelled manually beforehand. This entails high effort for knowledge acquisition and maintenance.
2. Dynamic and adaptable dialogs: The underlying idea for this class of dialog is to consider the product distribution within the product database. Questions will be selected according to their relevance for the customer's utility function (decides the usability of a product). The

selection mechanism works with a certain selection criterion. Such criteria can occur precompiled in the form of a graph structure or they can be dynamically interpreted.

The second class is the most interesting, because it gives the possibility to make the dialog more flexible, since it can adapt to the situation. The basis for dialogs is the selection of product properties to be specified by the customer. An e-sales dialog should always try to present a product that is the best choice given the properties specified so far. The remaining (unspecified) properties have to be examined considering what information they can provide. This means that the property that gives the most information gain should be selected (Schmitt, 2002). The information gain is computed using the structured product descriptions. The product properties are selected that allow to distinguish between the product descriptions most clearly.

Take for example this table, showing four different products, with some random properties. It is easy to see that the most differentiating properties are *brand, megapixels* and *price*. So the dialog should ask a questions which will fill in one of those property's, which when answered would reduce the current eligible product pool the most. For example, if the customer would have a certain *brand* in mind, e.g. Canon, asking that question would lower the product pool to 1, and that product can be offered.

Product	Megapixels	Brand	Price	Memory Interface	Warranty	Colour
Camera A	5 MP	Minolta	€ 300	Sd	6 months	Black
Camera B	3 MP	Canon	€ 200	Sd	6 months	White
Camera C	10 MP	Nikon	€ 1300	CF	12 months	Black
Camera D	8 MP	Sony	€ 950	MS	12 months	Gray

Table 1. Case-based reasoning applied to properties

2.2.3 Similarity based approach

Although CBR can greatly improve the sales dialog, it has a few shortcomings in its current form.
The current approach is based on an information gain measure that is used to select the next attribute to ask which is discriminating to the maximum in the product database, i.e. limits the number of product cases. The principal drawback of such information gain measures is that they can lead to several problems (Kohlmaier, Schmitt, & Bergmann, 2001) (Schmitt, 2002):

- Some of the approaches to CBR have their origin in the field of diagnosis, which implicitly assumes that the users the system deals with are ideal, e.g. they can and will answer all the questions. However, this assumption does not necessarily hold in a real world scenario. Online sales have to deal with lot of different kinds of customers, with different knowledge about products. A question can have a huge information gain, but if it is too hard for the customer to answer, it has no practical use in the electronic sales process.
- It has not been considered that each question has a cost side effect, the customer can terminate the sales dialog without buying as soon as a certain annoyance level is undergone.
- The original approach of CBR to sales dialog is only concentrated on dialog length. It is not considered how appropriate for the customer is the retrieval result (quality of the dialog). This retrieval result plays an important role in customer satisfaction, and binding customers.

To improve these shortcomings we will use a different measure for calculating the information gain, simVar based on the thesis of Sascha Schmitt, page 7 (Schmitt, 2002):

"We introduce a measure better suited for a dynamically interpreted dialog in our opinion. Instead of calculating the classical information gain, we consider the similarity distributions of the candidate cases to the current query. This has two major benefits: first, the measure is independent of the underlying interpretation of similarity; second, attribute weights (defined by the model and the customer's preferences) are also taken into account since our measure works directly on the retrieval results.

For a similarity-influenced information measure, a target situation is characterised by the similarities associated with each case. At the beginning, all cases have the same similarity and are undistinguishable. With every new attribute of the query, the similarity of each case changes. If enough questions have been asked, the cases with the highest similarity can be identified. These are the products with the highest probability of satisfying the customer's needs. So a target situation has a similarity distribution that strongly discriminates between cases with a high and a low similarity to the query, as depicted in Figure 6 (the grey bars indicate the target products)."

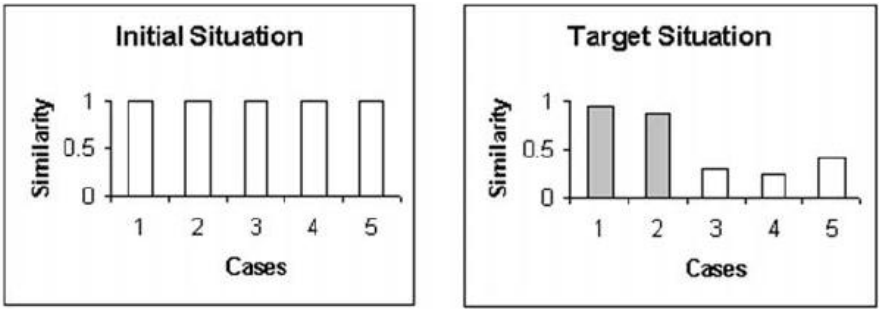

Figure 6. Target situation characterised by similarity distribution.

This measure for information gain takes into account the other aspects that play an important role in a e-sales dialog, and is therefore better suited for this approach.

The goal of a successful dialog is to extract enough information from the customer, while providing him with information at the right place. Customers are very quickly annoyed and are 1-mouseclick away from the next e-shop. The aim of Case-based reasoning is the shorten the number of questions (dialog length) and improving the overall quality of the result, so that the customer can be satisfied. A gain measure is used to select the question which is maximally discriminating the product database.

2.3 User Models

Like in the real world sales dialog, customers come in all varieties. Using user models helps the sales dialog adapt to those different kinds of users, and make the approach more personalized.
A cooperative sales dialog must take into account the customer's goals and plans, his prior knowledge about a domain, as well as false conceptions a customer may possibly have concerning product properties.
It is not the customer's task to construct a mental model of the technical functioning of the sales dialog. Instead, it should also be up to the sales dialog to form assumptions about what the customer believes, wants and plans, i.e. to develop a model of the customer.

2.3.1 What is user modelling

There are three views on what user modelling is (Vrieze, 2006). The first view is more literally and means user modelling is the acquisition of a model of a user. Second would be the usage of an explicit user model to adjust a system. The third approach would be to combine the two. This last approach means that the user model is explicitly available for the application, in this case the sales dialog.
Finin et al. (Finin, 1989) describe a user model as "The information that a system has of its users is typically referred to as its user model".
The tasks of a user modelling system given in that work are (Finin, 1989):

- Maintaining a database of observed facts about the user.
- Inferring additional true facts about the user based on the observed facts.
- Inferring additional facts which are likely to be true based on default facts and default rules.
- Maintaining the consistency of the use model by retracting default information when it is not consistent with the observed facts.
- Providing a mechanism for building hierarchies of stereotypes which can form initial partial user models.
- Recognising when a set of observed facts is no longer consistent with a given stereotype and suggesting alternative stereotypes which are consistent.

2.3.2 Applying user models to e-sales dialogs

A sales dialog should conform itself to the customer. Without a user model, the system can only respond to the user with relevant data by just responding in a mechanically cooperative way to the user's questions. The conversational setting for such dialog systems was somewhat unnatural compared to human dialogs. The user of these systems had to find an appropriate question strategy for getting the information, while the dialog itself hardly gives any assistance. User models are necessary prerequisites in order for a system to be capable of exhibiting a wide range of cooperative dialog behaviour (Wahlster & Kobsa, 1989).

Applying such a user model system to the sales dialog has certain advantages. The dialog can infer which knowledge the user has about the product, and adapts its approach and questions to that knowledge. Let's look to the tasks a user model should for fill, and apply those to the sales dialog:

Maintaining a database of observed facts about the user.
The sales dialog should remember the observed facts about the customer, so it can use those facts to alter its approach.

Inferring additional true facts about the user based on the observed facts.
The customer should be able to indicate his knowledge about the product in the dialog, so the dialog can take that fact, and adapt its questions.

Inferring additional facts which are likely to be true based on default facts and default rules.
If the customer has trouble answering technical questions about the product, by not answering them, or taking a long time to answer them, the dialog can infer that the customer doesn't have a lot of knowledge about the product. Then the dialog can choose different questions that are less technical.

Maintaining the consistency of the use model by retracting default information when it is not consistent with the observed facts.
If the customer has indicated the wrong level of product knowledge in the beginning of the dialog, the dialog should be able to observe that the customer had trouble with certain questions, and alter its behaviour to the customer.

Providing a mechanism for building hierarchies of stereotypes which can form initial partial user models.
Stereotypes can help decide which questions should be asked. Simple stereotypes would be: customers with almost no product knowledge, customers with product knowledge, but non-technical and customers who have a lot of product knowledge, also technical wise. These 3 groups should be asked different questions. The latter group probably knows very well which properties it deems important, while the first group doesn't. The sales dialog should be able to associate people with a certain stereotype, so it can adapt its questions to it.

Recognising when a set of observed facts is no longer consistent with a given stereotype and suggesting alternative stereotypes which are consistent.
If the customer is associated with a very technical stereotype, and has trouble answering the questions, the sales dialog should be able to associate the customer with another stereotype.

The whole goal of a user model is that the customer is asked the right questions. Right questions are the ones that can be answered easily, and are meaningful for the user. A user that has a good image of which properties the product should have, can be annoyed by questions that seem vague or obvious to him. While another user wouldn't be intimidated by technical questions, and is better off with those first questions. The user model will be discusses in greater detail in chapter 5.

2.4 Noncooperative dialogs

A more different approach is the so called noncooperative dialog. Typically a sales dialog has the role of an information provider whose sole motivation is to help a human information-seeker to achieve his goals. But in the real world not all dialogs are restricted to purely cooperative situations (Jameson, et al., 1994). The modelling of noncooperative dialogs, as opposed to dialogs in which the goals of the participants coincide, the goals of the participants are opposite. In the role of the potential buyer of a used car, the system tries to arrive at a realistic evaluation of the unknown car in spite of biased information presentation on the part of the seller. In the role of the seller the goal is to form a usable model of the buyer even while using this model to manipulate the buyer's impressions. To show how such a dialog works, an example is shown from the thesis of Jameson et al. (1994) the PRACMA dialog. This example is about the selling of an used car, where B plays the buyer and S the seller:

$\mathcal{B}$: Hello! How much gas does this car consume?

$\mathcal{B}$ begins by asking a question about an aspect of the car that is likely to have a major impact on his evaluation.

$\mathcal{S}$: Hello. It consumes 7 liters per 100 km.

$\mathcal{S}$ has now answered $\mathcal{B}$'s question; but since she interpreted the question as a sign of interest in environmental-friendliness, she takes the opportunity to volunteer the following additional information, which ought to make a good impression:

$\mathcal{S}$: It has a catalytic converter.

To be sure, this fact has somewhat negative implications for the dimension "sportiness"; but these implications are not known to everyone, and besides $\mathcal{S}$ has no evidence that $\mathcal{B}$ is especially interested in sportiness.

$\mathcal{B}$: That's too bad.

Explicit reactions like this are usually associated with negative evaluation shifts. So $\mathcal{S}$ now suspects that $\mathcal{B}$ is in fact interested in sportiness and probably also fairly knowledgeable about aspects of cars relevant to that dimension.

$\mathcal{B}$: What are the chances that the car will pass the next inspection?

$\mathcal{B}$ switches to another aspect that is important to his evaluation.

$\mathcal{S}$: It ought to pass the inspection.

$\mathcal{S}$ actually judges the car's chances to be only about 55%. She figures that saying this explicitly would have an unfavorable impact on $\mathcal{B}$; but on the other hand, to give a definitely optimistic characterization of the car's chances would be too untruthful. As a compromise, $\mathcal{S}$ chooses a vague, positive formulation, with which she expects at least to prevent $\mathcal{B}$'s evaluation from becoming much less favorable.

$\mathcal{B}$: Good.

$\mathcal{B}$'s evaluation of the car with respect to this aspect has apparently improved, contrary to $\mathcal{S}$'s expectation. $\mathcal{S}$ explains this mainly by postulating that $\mathcal{B}$'s initial impression of the car's chances of passing the inspection was unusually pessimistic.

Figure 7. Example of a noncooperative dialog

The example shows that the input of the buyer can be used to steer the dialog, which can lead to better selling results.

2.4.1 Noncooperative dialogs for e-sales dialogs

The big difference with the PRACMA system and the current e-sales dialog is that the PRACMA system uses natural language (NL) to communicate in a full dialog with the customer. Because it is out of the scope of this thesis to develop a NL system for the e-sales dialog, this system should be adapted before it can be used in the e-sales dialog. One option would be to define a number of question-answer tuples. A subset of these can be showed to the user when he has questions. By looking which to which questions the users wants to know the answer, the dialog can infer where his priorities are, or which properties he is interested in. These properties can then be given extra attention by the dialog, and questions relating the previous question can be showed.
For example, if the customer has questions about the performance of a certain computer system, and he selects the question "What is the game-performance of this computer?", the answer should be adapted using the user model. Technical users should get an technical answer, while non-technical users shouldn't. The model should show related questions to this one, e.g. "How fast is the computer in daily use?".

While noncooperative dialogs are a somewhat less traditional approach to sales dialogs, they can improve dialogs by inferring which aspects of products the customer deems important. This then can be used to put the attention of the customer to the properties he prefers, while not focussing on the less important properties (to the customer). It is out of the scope of this thesis to use the complete PRACMA system, because it assumes a full dialog between customer and agent, because the current dialog system would have to be greatly adjusted. But we can use the essence of the system, using it to improve the current sales dialog.

2.5 Informal methods

While the techniques discussed above here are scientific methods, there are also a lot of informal methods. We will discuss them in this chapter briefly, to show that they to have a huge impact on the dialog.
Like discussed before, one of the points that can be encountered with the dialog is that the customers can cancel it anytime they want. As soon as a certain irritation level has been reached, or attention span has been lowered, the customer is one mouse-click away from leaving the website.
Therefore it is important to keep the customers attention, and not to annoy him. To keep his attention you need to provide him with the information he desires, so he keeps focused.
To prevent annoying the user, the language should be adapted to the user's knowledge. When the dialog infers that the customer is non-technical, the questions should be adapted to that to. Same goes for technical questions for a technical customer. No customer likes being asked questions that are either impossible to answer, or don't add to the overall dialog.
Overall the customer needs to be guided through the dialog. This way the attention span of the customer is kept and the customer is more involved, reducing the chance on irritation and improving the quality of the overall dialog. If the customer isn't involved with the dialog, and as a result doesn't answer the questions seriously or honestly, the result of the dialog won't be to the satisfaction of the customer.

2.6 Conclusion

In this chapter we have discussed which methods are available for improving the e-sales dialog. These methods have overall a very theoretical base, and need adjusting to be used in a real life example like the sales dialog. While these methods are far from perfect, they can add to the improving of the dialog. The dialog can learn from previous customers, by adjusting the questions, and choose the questions more dynamically improving the overall success rate. When creating a model, we will use these techniques to improve the dialog.

3 Complex product sales in an digital environment

In this chapter we will look into complex product sales, especially in the digital environment. Internet sales are dominated by non-complex products, e.g. movies, books and clothing. We will try to find why this is. Also there will be a more expanded definition of complex products and how to categorize them. Also there will be a case about Dell, a company which has been very successful at selling rather complex products like personal computers via the internet. This case will look into why they are so successful. The goal of this chapter is to see how we can improve the complex products sales by looking into the products themselves. While this chapter concerns itself with complex products, and their online sales, there is another booming market on the Internet, and those are services. Take for example the buying of plane tickets, in the past this was only possible at travel agencies, while now everyone with an Internet connection can buy a plane ticket online. The difference between a product and a service is, that the customer experiences them differently. A service can't be complex in use, and are usually "what you see is what you get". If the customer buys a plane ticket, he knows that he flies from one place to another, the plane used is of no interest for the customer. Because of their growing popularity online, the selling of services online is a very interesting subject, and could be used for further research.

3.1 Classifying complex products

From the management perspective you look to the features of products, and want to know how customers deal with them. One way for customers to deal with them is to translate it to customer value, and go through the process of buying with a certain level of involvement. Typical example is that buying cola is done without giving it much thought, while buying a home cinema set the customer thinks more about it, and visits more stores before making the decision.

In 1.2.1 a complex product was defined as product which is complex to use or complex to buy. So either the usage is complex, or the buying process, or both. The usage can be complex because it is a complicated device in the arrangement of parts and units, so it is hard to operate without any background knowledge. The buying process can be complex because it is hard for the customer to assess the properties to which the product should comply. This means that the customer has problems assessing which internal properties will result in his desired external properties. E.g. which amount of memory (internal property) in a computer will result in a smooth operating (external property) computer. Therefore a 2x2 matrix is made to classify complex products. Complex in use versus complex buying process. This because even when a product is not complex in its usage, but still is complex for customers to buy, there is still a problem. The goal is to look to the features of products and see how customers deal with those. That makes it possible to distinguish between complex in use and complex to buy.

		Complex in use	
		Yes	No
Complex buying process	Yes		
	No		

Table 2. 2x2 matrix to classify complex products

Table 2 makes it possible to classify products in one of the four groups. These groups can all be approached differently by the sales dialog, based on their characteristics. This will be discussed in detail below here.

3.1.1 NOT Complex in use AND NOT Complex buying process

These are the easiest products to sell online, the products are relatively easy to use, and the customer can buy them without putting too much attention to it. This group is also very open to impulsive purchasing by the customers.
Because of their nature, they are already sold plenty on the Internet, for example: movies, music and books. All of these don't require complex decision making when buying the product. Customers usually know which products they want, and know how to find it. E.g. customers are looking for a certain movie they want to watch, or want to read books of a certain author. Also the price of these products is lower than complex products, which makes them also more suitable for impulsive purchasing.

3.1.2 NOT Complex in use AND Complex buying process

In this case, only the buying process is complex. This means that the products the customer would buy, isn't complex to use, but it requires a complex decision of the customer to decide which product he needs. The products in this category are highly customizable. They have so many different options that is hard for customers to decide which configuration of those options they want, and which configuration of those options relates will fulfil the need they have as a customer. This requires a dialog which through use of questions helps the customer pick the correct configuration of those options which best serves his needs.

3.1.3 Complex in use AND NOT Complex buying process

Complex in use means that the product is so complex, the user of that product finds it difficult to use. Especially without certain foreknowledge. The product and his features are so complex, that the customer doesn't know which features result in the behaviour the customer is looking for. E.g. what does increasing the RAM memory do to the properties of a computer? Therefore, the dialog should be able to link abstract and complex features to understandable properties, and help the customer decide which features they need to get the product with the properties they want.

3.1.4 Complex in use AND Complex buying process

In this case the product is both complex in use, as complex to buy. This is a combination of both cases mentioned above. It is hard to decide for the customer which features will fulfil the need of the customer, because there are so many combinations possible. From the other perspective the customers doesn't know which features result in the wanted properties of the product.

3.2 Example of complex products

In this part we will discuss some example products, based on the 2x2 matrix which was explained above. Each product will be briefly discussed. The table below shows example products for each of the categories:

		Complex in use	
		Yes	No
Complex buying process	Yes	computers, digital SLR	cars, kitchens
	No	mp3-players	books, movies, music

Table 3. Example of complex products in 2x2 matrix

3.2.1 NOT Complex in use AND NOT Complex buying process

Already mentioned in 3.1.1, these products are already sold on the Internet in great numbers. It are products which are relatively cheap, don't require a lot of investment, non-complex decision making. Products fitting in this category are books, movies, music.

3.2.2 NOT Complex in use AND Complex buying process

In this category we have products which have a lot of features, which can be changed. But the product itself is not complex, and most customers should be able to use it without any problems. It's the buying process that makes it complex, because of the plenty features, and customers not being able to decide which subset of features, or which configuration of features they need. Products fitting in this category are cars and kitchens, because of their highly customizable nature. Cars maybe a somewhat illogical choice here, since people need to learn how to drive a car, so the product could seem somewhat complex. But once you have a driving license you can drive almost any car without much trouble, since ever car operates the same way, e.g. the brake and gas pedals are aligned the same. Whereas for each mp3-player there is a separate learning curve because each mp3-player operates differently.

3.2.3 Complex in use AND NOT Complex buying process

Complex in use means roughly that the product is hard to use, if the customer would have no background knowledge, therefore the customer has a hard time deciding which features he would need to get to certain properties he wants. In other words, it's hard for the customer to relate certain features to certain product properties. A good example of this is the mp3-player, the configuration of a mp3-player is usually limited, the product is designed for one task, and is not highly customizable. But it can be quite complex in use, e.g. how to get the songs on the mp3-player or which codec's are needed.

3.2.4 Complex in use AND Complex buying process

This combines both aspects. So the buying process is complex, as well as complex to use. So the product is highly customizable, and it is hard to relate the features to product properties. A good example of this product is computers, since they are highly customizable, and it is hard for a customer to relate certain features to product properties. For example, the customer wants a fast smooth running computer, but he doesn't know how much RAM or how fast the CPU needs to be. Another good example for this is a digital SLR camera. It is hard for the customer to relate the features e.g. focal length multiplier to the making of pictures.

3.2.5 Conclusion

By dividing the products into four categories relating to their complexness we have a way of improving the dialog. Because each of the categories requires another approach, if the dialog can adapt itself to each of the four categories, it can assist the customer better.

3.3 Dell Casus

Since this chapter is about complex products sales in a digital environment, we will to look into a real life example. If there is one company that is successful in selling complex products (computers, printers, other ICT products) in a digital environment, it is Dell. This chapter will look into the company itself, how it came to be and tries to infer the properties that led to its success. Also the future of Dell will be discussed, which at this moment is rumoured to start physical stores to sell their products to improve their declining market penetration (Darlin, 2006).

3.3.1 History of Dell

Dell Inc. is an American company based in Round Rock, Texas. It develops, manufactures and sells computers, server, data storage devices, network switches and other technology-related products. In 2006 Dell employed over 78.700 people worldwide. Their biggest market is in PC and server sales.
It was founded in 1984 by Michael Dell who believed by selling personal computers systems directly to customers they could better understand the customers need and provide the most effective solutions to meet those needs.
Dell is known for their online sales. However they started by selling computers via the telephone and later using outlets like CompUSA and Best Buy. It wasn't till 1993 till they abandoned the retail store channel. In 1996 Dell took advantage of the Internet boom and began selling computers online. The online store concept matched the goal of Michael providing convenience and efficiency directly to customers. The online store debuted in July 1996, and in 1 year the sales of their online site increased from $1 million to $3 million a day. By 1998 Internet sales grew to exceed $12 million a day, moving Dell to the lead in the PC market (Dell, 2007). They remained on that position till recently, until HP slipped past them.

3.3.2 Success of Dell

Dell's core business was along the lines of a traditional value chain. Like most other PC companies, it focussed on building and selling complete systems, relying on suppliers to provide the components, software and services. The big difference was, like stated above, Dell sells directly to the customer, thus removing the distributor and reseller (figures 8 and 9).

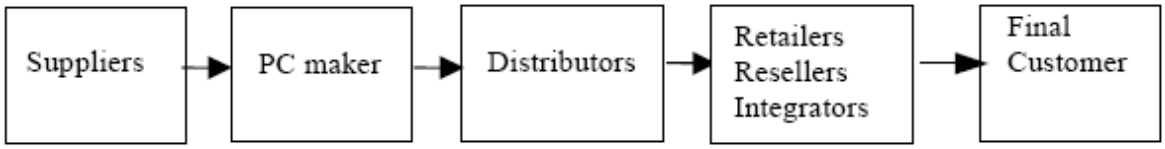

Figure 8. Indirect PC value chain

Figure 9. Direct PC value chain

But as Dell grew over the years, the model changes further, although it is still roughly the way how Dell operates. Dell now also lets certain products (e.g. notebooks) be built by contract manufacturers, and ships them from there to the customer. And as Dell expanded itself beyond selling PCs, the value chain is replaced with a new model called the virtual corporation (Kreamer & Dedrick, 2001) as showed in figure 10.

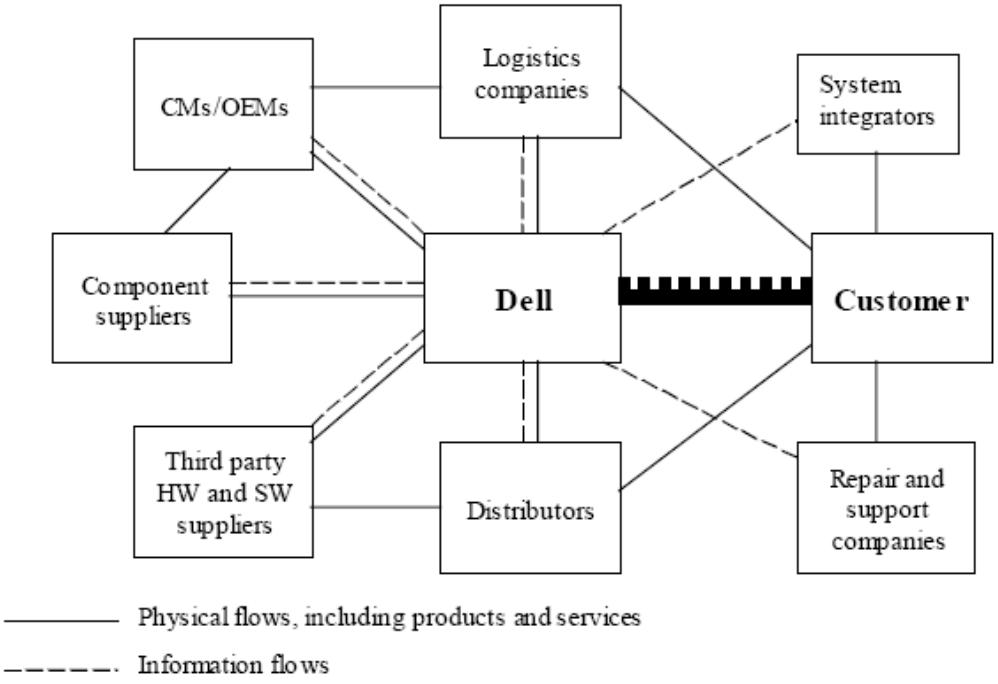

Figure 10. Dell's virtual company

The success of Dell is mostly due to their business model. Dell combines a direct customer model with a highly efficient manufacturing and supply chain management organization. They also focus on standards-based technologies. The following five key concepts define the Dell business model (Humphrey, Miller, Barfitt, & Ziegelmayer, 2003):

1. A direct relationship is the most efficient path to the customer.
2. Customers can purchase custom-built products and custom-tailored services.
3. Dell is the low-cost leader.
4. Dell provides a single point of accountability for its customers.
5. Dell believes that standards-based technologies deliver the best value to the customers

The first concept shows the reason why Dell doesn't work with retailers. This saves a lot of money, and provides a constant flow of information to their customers.

The second concept relates to the goal of Michael Dell, providing the most effective solutions to customers. This can be done by creating custom-built solutions. This is also a way to bind customers, by delivering custom and high quality products. The built-to-order process also achieves a faster inventory turnover, reducing inventory levels, thereby reducing costs.
By eliminating the retail channels and using the faster inventory turnover, Dell can reduce costs. This way they can follow the cost leadership strategy as described by Michael Porter (Porter, 1980), and stay the low-cost leader on the market. Porter's strategies are shown in figure 11.

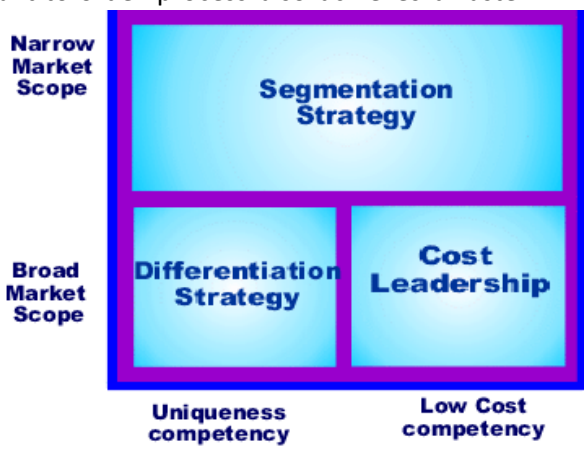

Figure 11. Porter's Generic Strategies

Dell manufactures most of the products they sell in one of six manufacturing locations worldwide. Because Dell develops all products in-house, the customers know who is accountable for their products, providing a clearer image for the customers.

Finally, Dell believes a standards-based focus generates customer benefits in two ways. First, using standard components distributes the costs of research and development among the suppliers. This ensures Dell the ability to implement "bleeding edge" technologies without having to bear the costs of extensive R&D.

Dell says its success comes from their intense focus on the customer. They believe their business model is the most effective means to gain insight into and satisfy the customer because communications occur directly with the customer by phone or Internet (Dell, 2007).

3.3.3 SWOT analysis Dell

To look closer to the strengths and weaknesses of Dell, a SWOT analysis will be made. This will show why Dell became such a big player on the market, and maybe it can be inferred why their market penetration is declining.

Strengths	Weaknesses
Single sourcing Efficiency Relationships with customers and partners After sales service Internet leveraging Product quality	Single sourcing New product market entry has hurt margins Reliance on corporate clients After sales service
Opportunities	**Threats**
Growth in overseas markets Industry is still in growth phase New product markets (printers, PDA's, etc.)	Technological changes Global economy Increased competition

Table 4. Swot analysis Dell

This SWOT analysis shows why Dell has achieved such a high market penetration. Single sourcing, relationship with customers and internet leveraging are the main contributors to the low cost, while relationship with customers, product quality and after sales service are the main contributors to customer binding. This combination, together with the Internet booming, made Dell one of the biggest players on the PC market.
The single sourcing aspect, which is one of the main contributors to the low cost strategy, is also a weak point. Because if that single sourcing disappears, it would be a big problem for Dell to find a replacement. The after sales service, which is also one of the strengths, is also a weakness, because Dell didn't own any offline stores, where customers could go to. Therefore customers who had a problem with their product would have to mail it back to Dell. This is one of the reasons why the customer satisfactions for Dell have dropped, see 3.3.5. The other two weaknesses are that the new product market has hurt margins. Dell has been expanding in other markets, like high end gaming computers and high end laptops, producing LCD monitors and other new hardware. This comes with an investment cost, and therefore is hurting their margins. The latest weakness is the reliance of Dell on corporate clients. This way they could miss out on the other markets, which promise significant growth.

The first opportunity is the ability to grow in overseas market. In 2003 Dell had 31% market share in the United States and approximately 10% market share outside the United States (Humphrey, Miller, Barfitt, & Ziegelmayer, 2003). This lead to the second opportunity, the industry is still in growth phase. Therefore Dell should be able to increase their sales outside of their home country. They can

also increase their market share by focussing on new product markets like printers, PDA's and other electronic appliances.

The biggest threat at the moment for Dell is the increased competition. Especially from HP in the desktop segment, and Acer in the laptop segment. This is further discussed in 3.3.5. Other threats are the technological changes that are coming from other industries. New techniques are devised to create cheaper chips (Intel), other sources of storage (Solid State Disks), or replacement hardware (Apple iPhone & iMac). Also the global economy is changes towards the IT industry. Lately the IT industry is pointed out as one of the biggest polluters of the environment. Therefore steps are taken to improve this, implicating that desktop builders have to implement those steps, increasing their costs (BBC News, 2006).

3.3.4 Example dialog at Dell.com

Since this thesis is about improving the e-sales dialog, we will take a closer look to the dialog Dell uses to sell its computer systems. The goal is to show how the dialog of Dell works, and what the weak and the strong points are.

For this example an Inspiron desktop for a home user from the American Dell site (http://www.dell.com) is chosen. This because the Inspiron is a budget computer, and is mostly sold to the overall normal customer, which is not an technology enthusiast. The dialog is depicted in pictures step by step, shown in Appendix A.

As shown in A.1 of Appendix A, the 3 different kinds of desktop Dell offers are shown on the page. Descriptions under the desktops, and the prices offered should give the customer an idea what to expect for the money. For this example we go for the Inspiron series, since this is the budget line, which should be the best computer for normal customers who aren't technology enthusiasts.

After that we get the choice between the slimline and the normal desktop, or the custom built option. We choose for the normal desktop. From here we get to some preconfigured desktops, which we can customize further. After choosing the second desktop on the left, and choosing a protection plan, we get to the real dialog, which lets us configure this product further.
The dialog consists out of 4 steps. The first step is configuring the computer itself. It addresses all internal properties like the processor, memory, hard drive, etc. For each property a choice is pre highlighted to show what the predefined build has in it. Although these properties are very technical, each property has its own help menu, which is shown in Appendix A.6. These help menu's exist out of 3 tabs. The first tab is an overview tab, which describes the certain property in details. The second tab has recommendations for what the customer should choose, explained in common terms, so non technical people can read it to. The third tab is for technical people, since it show the technical aspects of that property.
After configuring the properties of the desktop computer, the dialog goes to step 2, which is the selection of accessories for the desktop. This includes printers, speakers and other software. The dialog has been structured the same way as in the first step, showing several options for each property. Also it has a help menu for each property.
The third step is the so called "protecting the investment" step. This one includes warranties, getting started help, protection against incidents, etc. The dialog is again modelled after the first step. Showing several options for each property, including help.
The last step is the review step, which shows what the customer has chosen for all the properties, and shows what the final product will be like, and what the costs are.

The most important aspect is that the dialog is still very technical. While choosing a desktop computer, which already is preconfigured, the customer is still confronted with the technical aspect of confirming or changing every property of the desktop computer. The help offered with the "Help me choose" feature is very well thought of though. It offers information for non-technical people, by showing how certain properties relate to certain features. Like shown in figure 12, the size of the memory is related to certain functions the computer can perform. This makes it easier for non-technical customers to relate how much memory they would need. But still it makes those customers think about technology they don't have much knowledge over.

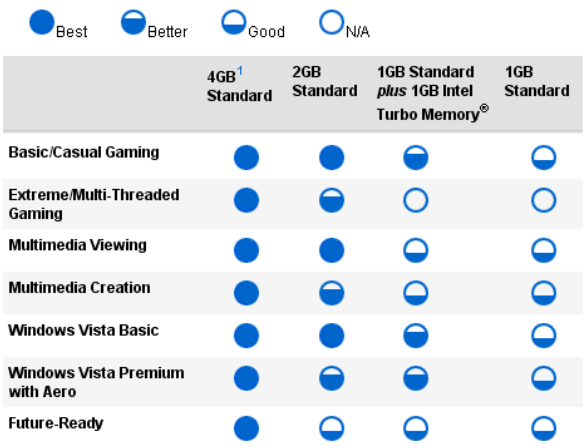

Figure 12. Memory comparison at dell.com site

3.3.5 Changes at Dell

Although Dell has been the largest computer manufacturer for quite some time, it lost its market leader ship in 2006 to HP (Nystedt, 2007), in 2007 it even lost more of its share to HP and Acer (Nystedt, 2007). HP's market share rose to 19,2%, widening its lead over Dell, which held a 14,6% market share in the PC market. In the notebook division Acer snatched away the second place of Dell. Reasons for this decline of Dell's market share are the circumstances the company got in. A survey in 2007 (Jowitt, 2007) showed that the customer satisfaction levels of Dell have fallen again. Dell was once the highest ranking computer business on that index (Krazit, 2004), but has dropped to one of the lowest scorers. Financial restatements and leadership changes are other factors which contribute to their declining market share. One of the main problems was that Dell couldn't grow as fast as its competitors despite strong global PC market growth. The company's quarterly earnings highlight this issue. Despite strong revenue growth, rising costs cut into profits and the company warned that future earnings could be hurt by cautious PC buying among financial customers (Dell, 2006).

A remarkable change in Dell's sales model, which might have been a result of the declining market share, is the opening of stores. This would be a logical move, since Dell is losing market share to competitors who do sell in stores. In the summer of 2006 Dell opened two stores as a test in a shopping mall, creating a hybrid of Dell's direct model and a conventional store. The products of Dell were on display, but the customer still had to order the PC online. The products would also be delivered as if they ordered it via the Internet at home, like the normal customers do. Therefore Dells claims that it isn't losing confidence in the direct sales model, which made it one of the biggest sellers of PC's. The tenets of the model should remain the same, according to Dell (Darlin, 2006).

This news was followed up in 2007 that Dell would start selling PC's through the American retailer Staples (Dell, 2007). Eventually in 2007 Dell announced that it would start cooperating with Carrefour in France, Spain and Belgium, Courts in Singapore, Gome in China, Bic Camera in Japan, Carphone Warehouse in the United Kingdom and Wal-Mart in the United States, Canada, Brazil en Mexico.

3.3.6 Conclusion Dell casus

Dell has grown from a one-man student company to one of the biggest players on the PC market. Their growth is mostly because of their direct sales model, exterminating the middle man. Dell used at first telephone communication for this. Later when the Internet boomed, Dell was the first PC company to use Internet's possibility to their full extent. Now, after they became the biggest PC manufacturer in the world, they have a declining market share because of the stagnant Internet

sales. They try to improve this by going offline, opening stores and selling their products in other retail stores. What the remarkable is of this strategy is that they lose one of their core competences, exterminating the middle man, since the retail stores also need to make profit on their sales. This will only increase the cost of the systems, and therefore would minimize the profit. More interesting to see would be why their online sales are stagnant and if there is a way to improve those numbers. One of the reasons mentioned above is the declining of consumer satisfaction, this combined with the fact that the dialog provided on their site is mainly technical, and not very communicative toward non-technical customers, this could be an interesting point to investigate. These are interesting points of view for further research, where also can be looked at improving the dialog, which then can offer better product selection for their customers, and provide better support. That way Dell could keep its direct sales model, whilst improving their weak points.

3.4 Conclusion

Customers translate features of products to customer value. This value decides if they want to buy the product. Increase in this value would mean an increase of sales. By making products less complex, customers understand the features better, and the value will increase. So one solutions to increase the sales should be to make products less complex. This can be done by giving complex products a less complex decision making process by using a modular composition, or a well thought design. A good example of this is the iMac from Apple. It is a computer, but it isn't marketed as one, it's marketed as 1 whole product, which can perform tasks the user wants. And not as a highly complex machine which performs binary operations. This is why the iMac, although it's a very complex technical product, sells very well under the less technical people. The number of choices in the hardware is kept deliberately low, so customers don't get confused.

By dividing products into four categories it gives the possibility to adapt the sales dialog to each one of the category, thereby improving the dialog for those products. For further research it is interesting to see if the four categories, created by two measures, complex to buy and complex to use, are distinct enough to encompass all products. Because there is another big property that influences customers when buying a product, the price of the product. Cheap products have shown to sell a lot better on Internet, this becomes even more clear in the next chapter. A good explanation for this would be that cheap products require less level of involvement, and customers are there more easily swayed to purchase the product. The 2x2 matrix would then have to be expanded with a third measure, price, this would result in a 3d matrix, as shown in figure 13.

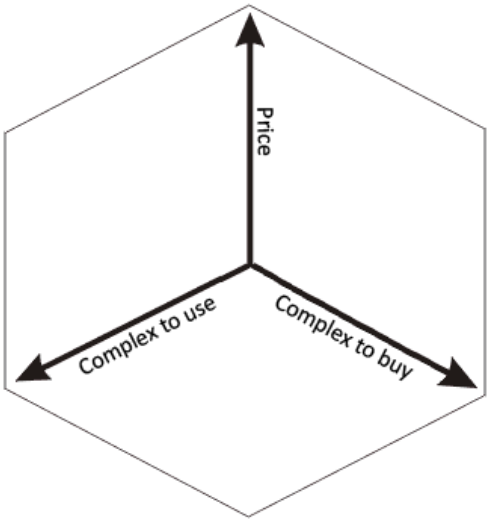

Figure 13. 3d model with new measure 'price'

Although the adaptation of the dialog to the categories will help it improve for certain types of products, there will still be products that will never successful sell online. These are products with a high emotional value, which often require real life inspection before the customer wants to buy them. Good examples of this are houses and cars. Before a customer wants to buy a car, he wants to make a test drive. The internet can never replace this. But the Internet can offer assistance and guidance.

4 Customer Research

This chapter considers the customer research. The goal of this chapter is to give insight in buying habits of customers, especially on the Internet. Therefore a small scale customer research is conducted to get insight in those habits. The customer research was held under a small population of people from various ages and education. The size of the respondent group is about 25 people large. This brings some generalisations issues with it, but considering the scope of the thesis, the respondent group is sufficiently large enough to conclude basic statements.

The customer research consists of a questionnaire consisting of 13 questions. The questions are a combination of open questions and multiple choice. The multiple choice questions offer the possibility to categorize answers easily, while open questions provide better insights. The original questionnaire is given in Appendix B.1. Since the market research was performed in the Netherlands, the questionnaire is in Dutch.

Like stated above, the goal of the customer research is to give insight into buying habits of customers on the Internet. These habits, and remarks then can be used to formulate a user model. This user model will be presented in the next chapter.

4.1 Results

The results are based on the replies on the questionnaire. To process the multiple choice answers statistical software is used to create graphs showing relations between properties. For the full size graphs see Appendix B.2.

The questionnaire showed that a little less than 80% of the respondent group buys online. More interesting to see is how this relates to age.
Age is divided into 4 categories, *12-17*, *19-29*, *30-50* and *>50*. Age was categorized because of the relatively small respondent group . Also it is easier to see how age relates to online shopping behaviour. The age group under 12 is not used in this questionnaire, since none of the people in the respondence group fell into that category. Also it can be assumed that this category will nearly not be present in internet sales.

The first category, *12-17* is pre-adulthood. This group doesn't have a lot of own money, and are still quite dependant on their parents. Therefore it is not unexpected to see that they are relatively behind in internet sales. This can't be helped, and is not going to change.
The second category, *18-29* is young adulthood, this group has grown up with internet and has the funds to make use of it. Therefore it is expected to see a relative high percentage that uses online shopping there.
The third, *30-50*, is expected to lag a little behind. The older they are, the more legacy will be an issue. These people haven't grown up with the Internet, and are more reluctant to use it.
Same goes for the last category, *>50*, which should suffer the bigger extent of the legacy problem. For both of these categories it is expected that this legacy issue will dissipate over the years, since the current generation has grown up with the Internet.

Figure 14 shows the relative relation of shopping online and age. It shows that the biggest part of the respondent group that doesn't shop online is in the latest 2 categories, which was to be expected. The expectation was that the older groups would be more reluctant to use the relatively new Internet for purposes like shopping. Remember that this graph doesn't relate the shopping with the non-shopping group, since the percentages are relative, all the blue bars together are 100% and all the green bars together are 100%.

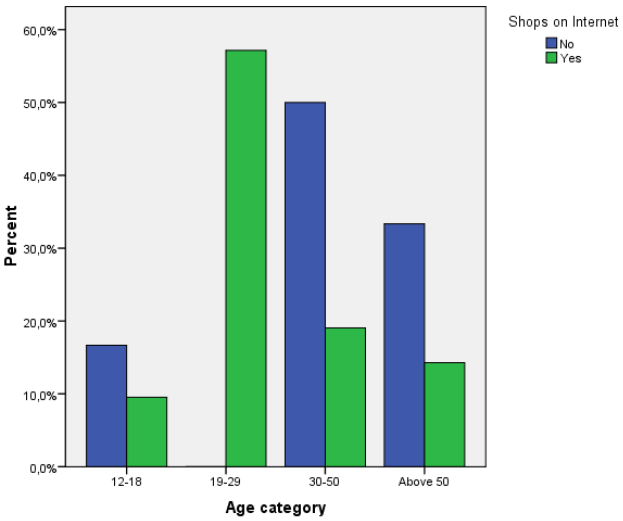

Figure 14. Relative percentage that shops online per age category

My test group consisted out of 27 people. Their age is categorised as followed:

Age category:	12-18	19-29	30-50	>50
Percentage:	11,11%	44,44%	25,93%	18,52%

Table 5. Age category partitioning

To be able to normalize the data, we need the demographic data of the Netherlands (CBS, 2006). The demographic data is shown below in table 6.

Age category:	0-11	12-18	19-29	30-50	>50
Percentage:	12,25%	12,25%	12,00%	30,40%	33,10%

Table 6. Demographic data of the Netherlands

Since the market research doesn't consider the age category *0-11*, we have to normalize those values, as showed in table 7.

Age category:	12-18	19-29	30-50	>50
Percentage:	13,96%	13,68%	34,65%	37,72%

Table 7. Demographic data of the Netherlands with same age categories

This data then can be used to normalize the data retrieved from the questionnaire. Using the next formula we can get a normalized diagram.

$$res * \frac{N_{act}}{N_{avg}}$$

Where N_{act} is the percentage of that age category present in the questionnaire. N_{avg} is the percentage of people in that age group according to the demographic data. And res is the number of people from the test group that fell into that category.
Using this, we can create a graph that shows the relative percent of the respondent group that shops online, see figure 15.

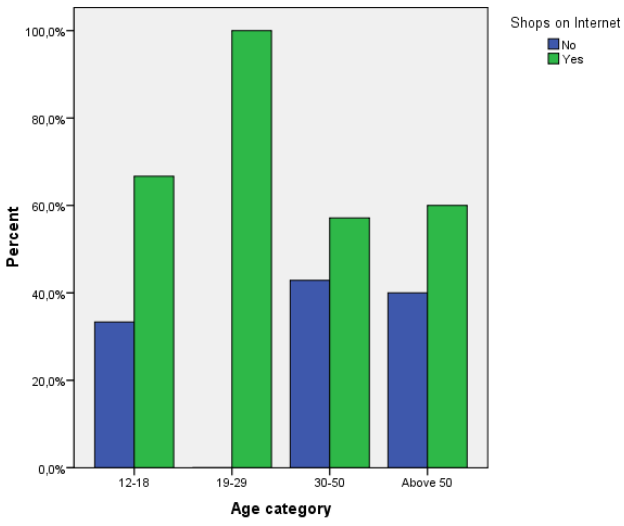

Figure 15. Relative percent of target group that shop online

The interesting part is that in the group of *18-29* year old buying via the Internet is so common, all of the respondent group in that category claims to use it. Even in the category *12-18* a majority shops online. Although the number of people in this category was limited, and therefore less accurate.

The other two categories, *30-50* and *>50*, have the same reasons for not buying online, for both categories the respondent group explained that the lack of affinity with the Internet is one of the main reasons for not buying online. Since this is a legacy issue, it will fade out, since the current generation has grown up with the Internet.

Other interesting conclusions are the fact that there is no real difference between genders when it comes to online sales, for both genders approximately 80% buys online. See figure 37 in Appendix B.2.

A little above 30% spends on average €20-€50 per purchase, little under 60% spends between €50 and €100, and about 10% between €100-€250. None of the respondent group spends under €20 or above €250. Reasons for this are that the shipping costs make it not worth the money to spend under €20 euro. While more than €250 doesn't happen often, and these purchases are less impulsive, and usually require a bigger level of investment of the customer. Therefore more customers tend to go to specialised stores to help them make the right decision.

A small detail is that men tend to spend more money on average than women. About 17% of the men spend on average between the €100 and €250 euro. While there are no women that spend that amount. See figure 40 in Appendix B.2.

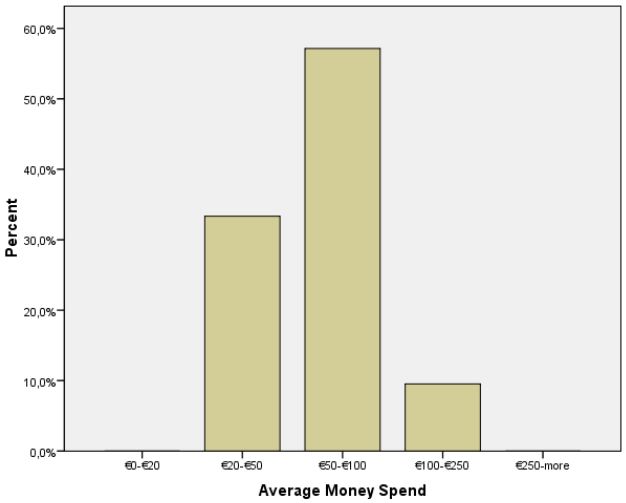

Figure 16. Average money spend

Another interesting graph is average money spend compared to age. Figure 17 shows that for each age category the greatest part of the respondent group on average spends between €50 and €100. The fact that people between 30 and 50 spend more on average could be related to the fact they would have more to spend. While it is expected to see the same pattern for the group *>50*, it is not. This group is divided between €20-50 and €50-€100. A possible explanation would be that they are reluctant to spend a lot of money online, since they don't think of it as reliable.
The biggest deviation is the *12-18* group, because 50% of that group spends on average between €100 and €250. While it is expected that this group has less to spend, because it is still very dependent on their parents, they also have very few burdens, like mortgage, or insurances.

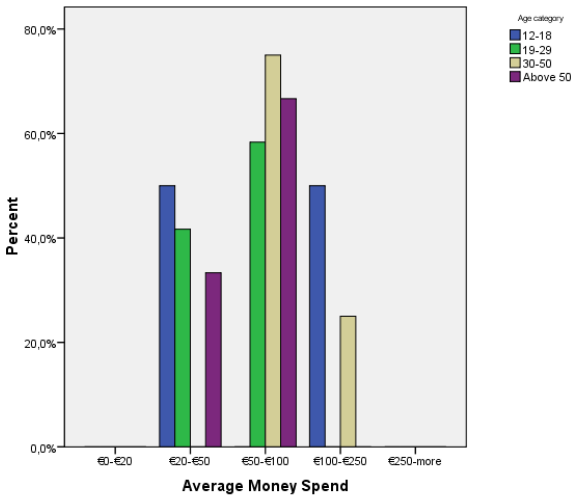

Figure 17. Average money spend compared to age

The amount of shopping per year is between 1 and 10 times in the respondent group . With a mean of 4.05 and a standard deviation of 2.397.
It shows that men shop more online per year then women. Men have a mean of 4.85 and a standard deviation of 2.609, while women have a mean of 2.75 and a standard deviation of 1.282. See figure 42 in Appendix B.2.

What figure 18 also shows, is that there is a very small group of people that shops deliberately more than the other people of the respondent group . They can be seen here as the lone bar on the right of the graph. What can be interesting is to see what kind of people this are, because if they

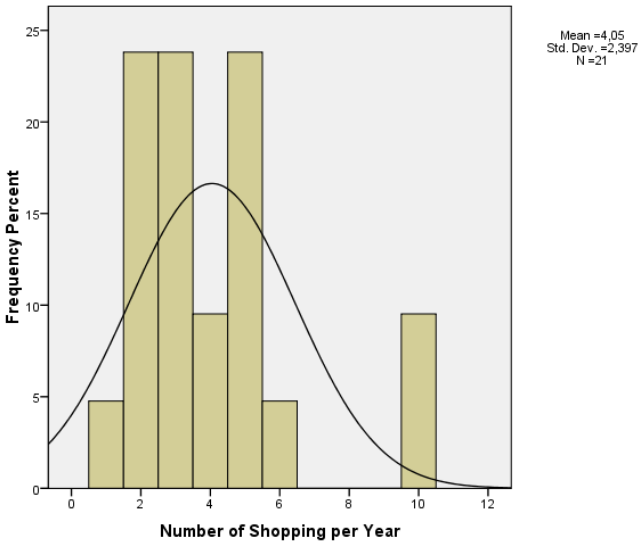

Figure 18. Number of shopping per year, with normal curve

can be bound to a certain web-store, they can make a lot of profit for the store owner.
That group spends about 75€ on average, this means that this would result in 750€ on average per year per person in this group. This is more than the other groups, for it would take the average group $\frac{750}{4.05} \approx 185€$ on average to keep up with the spending pattern of that group, which are only few who manage that, less than 10%, as shown in figure 16.
Relating to the questionnaire, the people that shop on an average of 10 times a year, a lot more then the mean of 4.05, are very experienced with online shopping, and usually know exactly what they want. They don't expect long dialogs, but expect a fast and efficient system to bring them to the product they want as fast as possible.

The respondent group is mostly confronted with an interface that uses search words or product types, and after that shows a list of products, about 60%. While 20% only is confronted with a simple list of products. And also about 20% is confronted with a dialog which asks questions to determine which product the customer is searching for.

The respondent group was asked to provide 3 things which they found appealing and useful about using their favourite shopping website. What frequently was mentioned is the possibility for exact searches like the ISBN and author for books and titles and directors for movies. The possibility to see all the features of a product in one glance is also mentioned. It should be stated though that most of the favourite websites are bol.com, amazon.com, marktplaats.nl, and several web stores that sell clothing. All these products are low technical and don't require a high level of involvement of the customer.

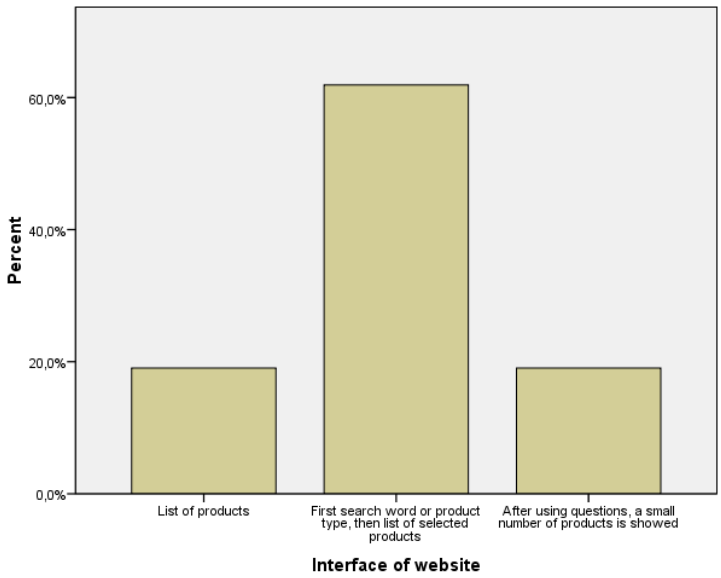

Figure 19. Interface used by target group

To get more insight in what type of products are sold more often, the questionnaire asked the respondent group to select the products they bought online. The selection consisted of: books, movies, mp3-players, clothing, software, courses, computers and cameras. These products are chosen consistently with the matrix for complex products defined in 3.1.

		Complex in use	
		Yes	No
Complex buying process	Yes	computers, digital SLR	courses
	No	software, mp3-players	books, movies, clothing

Table 8. Products used in questionnaire according to the complex products matrix

The respondent group was able to provide more than one answer to this question, therefore books was made 100% so we can see how this relates to the other products.

Books	Movies	Mp3-players	Clothing	Software	Courses	Computers	Cameras
100%	46.66%	26.66%	93,33%	46.66%	13.33%	60,00%	46.66%

Table 9. Product list from respondent group

If we can relate this back to the complex products matrix, we could determine where the most sales are made. But because not all products are represented equally we need to normalize them. The following formula will be used:

$$100 * \frac{\frac{N_{cat}}{P_{cat}}}{R_{tot}}$$

Where

$$R_{tot} = \sum_{i \in C} \frac{N_i}{P_i}$$

C represent the collection of categories, which is here the four mentioned in the complex product matrix. For each of these categories the total number of products the respondent group choose that fell into that category is then divided by the number of types of products that fell into that category. E.g. $N_{complex\ in\ use\ AND\ complex\ buying\ process}$ would be the total number of times the products computers and digital SLR have been chosen by the respondent group .
$P_{complex\ in\ use\ AND\ complex\ buying\ process}$ is the number of different product types in that category, which is 2. To get to a percentage we need to divide this number through the sum for each category the total of all products selected divided by the number of types of products, R_{tot}.
This results in the following table:

		Complex in use	
		Yes	No
Complex buying process	Yes	29,09%	7,27%
	No	20,00%	43,64%

Table 10. Relative percentage of products in complex products matrix

Even after normalizing it clearly shows that the non-complex products are the most popular on the internet. This was of course to be expected, most popular e-stores sell products that fall into that category. What is remarkable is that the most complex category is the second most popular. This is caused by a modest success of selling computers online. Although this is getting more common, there were enough remarks on the buying of complex products online.

One of the main advantages of shopping online that is mentioned is the lower price compared to that of retail stores. Also the possibility of offering a large amount of products is considered an advantage. Other advantages mentioned are: not having to leave the house, and the possibility to get it delivered at home. Customers aren't bound by opening hours and customers don't have to wait in line. Comparing prices is a lot easier, and it's easier to look around in different stores.

The disadvantages are mostly about the absence of good service, and the lack of information when the customer doesn't really know which product it needs. Also the lack of reliability is mentioned, but this is improving through the use of marks, which gives the customer the ability to hold the e-store responsible, should there be an issue with the order.
The biggest reasons of the respondent group that would increase their amount of online shopping are the increase in reliability, the ability to get answers on questions, more service, and more guidance. The latter ones are mentioned if the customer wants to buy a product of which they aren't an expert on, so they would need guidance to be able to buy the product. Also the forwarding-charges should be lowered or removed all together.

4.2 Conclusion

The customer research showed that Internet shopping is more popular than was anticipated, but there is a lot to improve. It was clear to see that the non-complex products are much more popular to be bought online then the complex products. This can be explained by that those more complex products are also more expensive, figure 19 shows that the average amount of money spend is around €50 to €100 euro, these complex products are usually more expensive than that. Also they require more customer involvement in the buying process.
The complex products on the other hand require more attention, in the way of guiding, and service. Customers that lack the knowledge of buying a certain complex product are still dependant on offline guidance from retail stores to get their information.
When looking at the interface the customers are faced with, the most part, 80%, it is a list of products, whether organised by product type or keyword. This means that only 20% of the websites

uses a dialog to communicate towards the customer. Combined with the fact that the respondent group mentions that there is too little communication and service towards customer, dialog could help improve the overall e-sales process.
The questionnaire also showed that non-complex products sell the most, which was to be expected. The more complex products sell less, because the customer has no real way of being guided through the buying process. So by improving the way websites communicate with customers, the other categories should be able to improve their sales.
But this doesn't mean the Internet doesn't play a vital role when it comes to buying complex products, the Internet plays a more explorative purpose, and they use the Internet to find specifications and the suggested retail price. And use product review to judge the value of the product. Armed with that information they go to the retail store and buy the product they need. Yet there is an a substantial group which does the same, only then armed with that information, shops at a web shop. This group knows exactly which product they need, so they can navigate the web shop quickly, since they can browse towards the exact product they want.

5 User Model

This chapter consist of the user model created for this thesis. The user model is based upon the results of the customer research and the conclusions from the previous chapters.

5.1 Presenting the model

The user model is a model to give insight in the user, how it behaves, what it goals are and what it wants to do to reach those goals.
The goal of the model is to give an image of the customer and how that customer related to online sales. The model consists of five parts. The first part is explaining the basic concept of the model.
The second part is about the interaction between the customer and the dialog. The third part relates to how customers deal with the dialogs. The fourth part is to see if patterns can be derived from the customer's behaviour to the dialog. The last part is to discuss the model, to see where improvement points are.

5.1.1 Use-cases

The model will be presented using use-cases. A use-case is a technique used in software and systems engineering to capture the functional requirements of a system (Pressman, 2000). They provide insight in how the system will be used.

Use-cases describe the interaction between a primary system actor, the initiator of the interaction, and the system itself, represented as a sequence of simple steps. Actors are people or devices that use the system or product. They take part in a sequence of activities in a dialogue with the system, to achieve some goal: they may be end users, other systems, or hardware devices. Each use case is a complete series of events, from the point of view of the actor.
In this case the actor will be the customer, and the system will be the e-sales dialog on the webpage.

5.2 User Model

The goal of the actor, the customer of an e-store, is to buy a product that would fulfil its need. The e-sales dialog is the system that should help the actor to achieve that goal. The model shows which actions the customer takes to achieve that goal. Each of these actions will be discussed using use-cases. For each of these use cases it should be considered how the dialog could help.

The different use cases are based upon the results from the customer research. The customer research showed that customers either exactly know what they want, because they have done their research, either via Internet or offline, or are knowledgeable on the products subject.
It starts with the customer visiting the web store. This is done via a browser. After this the customer can undertake a different set of actions. He can feel an explicit need, and therefore needs the possibility to search for the product quickly. This can be supported with use of the dialog. The customer can have a vague need, he feels he has a need, but doesn't really know which product he needs. The dialog will play an important part in this. For customers who don't have a need, but are just looking for bargains or just want to browse the items available, will need a browsing option.
After the customer has selected the product he needs, he will want to purchase and pay for the product.

Figure 20 shows the use cases, the actions the customer can take when visiting the e-store. Each of these actions will be discussed further below.

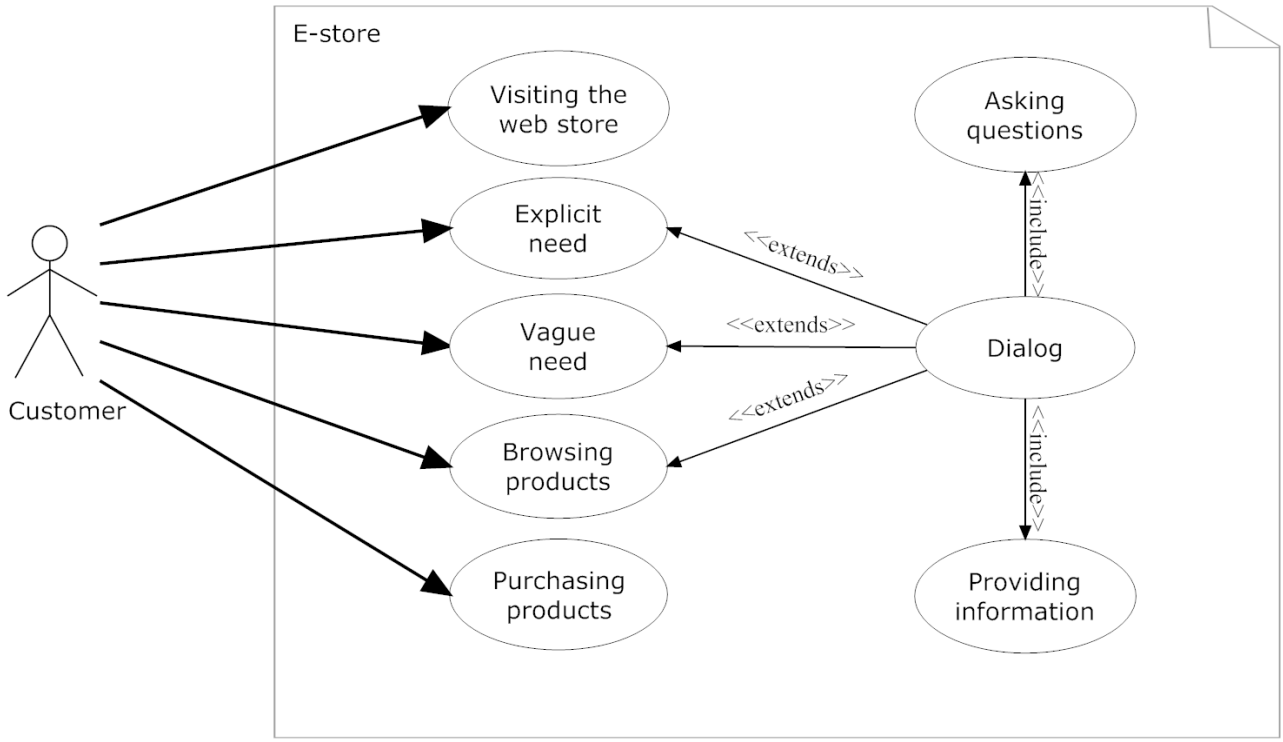

Figure 20. UML scheme of the use-cases

5.2.1 The customer visits the website of the e-store

This is the first step the customer has to take. It visits the website of the e-store and is confronted with the dialog which should guide him through the buying process. The customer expects a helpful dialog that will adjust to the level of knowledge the customer has of the product, and helps him find the product he needs.

5.2.2 The customer has an explicit need for a certain product

The customer comes to the e-store, but already has an explicit picture of the product it needs.
This use case is extended by the dialog, which means that the dialog is used for this use case. Since the customer already has a clear need of the product, the goal of the dialog here is to provide information, e.g. price, delivery time, warranty, etc. Also it should give a straightforward option the select the product the customer needs, e.g. via product name, product category or ISBN search. The customer expects to be able to get to the product he wants fast, and that information like delivery costs are easy to get.

5.2.3 The customer needs help to determine the need

The customer comes to the e-store, but has a vague need of what he needs. The customer therefore needs guidance to find the product that fulfils his needs. The dialog should assist the customer by giving the information the customer needs, and using questions to determine which features are wanted by the customer. Therefore this use case is also extended by the dialog. The dialog can use questions the determine the product the customer needs, as well provide information about the product. The customer expects a somewhat more slow experience where he gets enough information back from the dialog, based on his answers to be able to decide which product he needs.

5.2.4 The customer just wants to browse the products

The customer comes to the e-store, but has no specific need, it wants to browse products, to look around. Still this use case is also extended by the dialog. The dialog would has a little role in this part, it should give the customer the option to view certain classes of product, e.g. a certain brand, or new products, or discounts. It can provide information on the products when needed, and provide answers to questions about features of products should the customer need them answered. The customer expects that he is able to browse products at his leisure, and is able to ask specific questions should they arise.

5.2.5 The customer purchases the product.

After the dialogue has guided the customer to the right product the customer can purchase the product. Extends *Explicit need*, *Vague need*, *Browsing products*. The customer expects that he can pay easily, using various methods, and that the overall costs are clear and logical.

5.2.6 Dialog

The core of the e-store. It provides guidance, as well as information for the customer. It uses a database for asking and answering questions to guide to customer to the right product that fulfils its needs. Includes *Asking questions* and *Providing information*. The customer expects that the dialog works in his advantage, doesn't irritate him, and can answer questions fast and in clear language.

5.2.7 Asking questions

Is one part of the dialog, this part asks questions and interprets the answer the customer gives to fill in features. These features can then be used to determine which products meet them, and present those products to the customer. The questions should be clear, so the customer knows what is expected from him

5.2.8 Providing information

If the customer has questions about certain features, e.g. what the use of a certain feature is, or what the feature adds to the product, the dialog should be able to answer those questions. The information provided should be clear and on the level of the customer's knowledge.

5.3 Conclusion

The dialog should be able to determine what the customer is up to, and what kind of guidance he needs. The dialog should never irritate the customer, and should always be clear and understandable. This information can be used to create a model for the dialog, to improve the current dialogs and improve the shopping experience for the customer, hence increasing the sales. This then can be used to improve the model for the dialog, which will be discussed in the next chapter.

6 Model dialog manager

In this chapter we will look to the dialog manager, which is the instance that determines how the dialog responds to customer behaviour.
This chapter will be about the model for improving the e-sales dialog. It is based upon the user model from the last chapter, to anticipate how customers will react. This model will be proven by a proof of concept in chapter 7.

6.1 Presentation of the model

The goal of this model is to improve the current sales dialogs. We therefore assume that the dialog is management by a dialog manager. The dialog manager is responsible for how the dialog will react to the customer. To make a model of how the dialog manager should work, we look back to the user model. In chapter 5 we determined that there are 3 use-cases in which the dialog is active to guide the customer through the buying process. For each of these cases a model will be created how the dialog manager should handle these cases. To create these models we look toward the discussed techniques from chapter 2 and the experiences from other sites discussed in chapter 3. These models will then be proved via a proof of concept in the next chapter.

6.2 Model

In the user model we determined the use-cases for a customer. Three of them are guided with help of the dialog. These are the case where the customer has an explicit need, a vague need and when the customer just wants to browse products. The model for the dialog will address these three use-cases.

6.2.1 Explicit need

This need resembles how the most e-sales currently operates. It is expected that the customer knows which products he needs, or that he can find it for himself. This relates to a site more table based as we see a lot now online. This combined with a search form so the customer can find the product he is looking for fast.

6.2.2 Browse products

This case also resembles how the most e-sales sites currently operate. Customers are left to themselves, so they can freely browse the products of the e-store. Although this usually comes without any support. There is where the dialog manager comes in. The dialog should be there to assist the customer if he has questions.
The dialog manager can assist here by being there in the background of the website. The customer can consult the dialog when needed.

6.2.3 Vague need

This is the most interesting use case, and also the most problematic. Current sites do not adapt themselves to these customers. These customer need specific guidance from the dialog. This group is also the group that promises the biggest growth, since this group currently goes to an offline store, to get the guidance they don't get online. The goal of the dialog manager for this customer group is to find a way to retrieve the requirements the customers propose to the product they need to the actual product that has those requirements. Because the requirements the customer proposes on the product are not technical but more practical (e.g. the computer has to be able to create flyers),

while the internal properties of the product are more technical (e.g. 2048MB of memory), there has to be a conversion step between those, to get to the product the customer needs.
The goal is to propose a small selection of products which match the need of the customer, so the customer can chose the product from that collection. As example throughout the model the buying of a computer will be used, this its properties match well with the goal of the model. This because the product is complex, it is technical, and it needs a certain translation from customer needs to internal requirements.

To solve this problem, a mathematical approach is taken. The dialog will first need to get from the customers need to a collection of features (F) which are the demands the customer has. From those features the dialog needs to translate those to internal requirements (R) for the products. The dialog then can use the internal requirements to get a selection of products which accommodates those requirements best, basic information retrieval. For the sake of simplification all domains will be $[0,1]$.

6.2.3.1 First step

The first step will be to extract the features the customer deems necessary for the product he searches. These features can be extracted by asking questions. The dialog manager has a list of predefined questions which relate to certain features. Each questions is then picked using a case based reasoning method, the question that should give the most information gain should be selected. At the end of the first step, the dialog then possesses the interest of the customer for each feature. Since this technique has been discussed in other papers it will not be discussed here again (Bergmann, Schmitt, & Stahl, 2002) (Schmitt, 2002).

6.2.3.2 Second step

The second step is to get from the features to the internal requirements. This function can be described as $F \rightarrow R$.

Where F is the relevant features retrieved in the first step, and R the internal requirements of the product. To get from features to internal requirements we need to make several steps.

Say the customer deems the making of flyers as an important feature. The making of flyers will then be in F. To be able to make flyers the computer needs a certain CPU speed. So CPU speed will be in R. A single feature can be related to many internal requirements, whereas many features can be related to a single internal requirement. E.g. the feature 3d design requires certain CPU speed as GPU power. Whereas the designing of flyers and the playing of games both make different requirements on CPU speed.

We will first try to create a model where 1 feature is related to 1 internal requirement. For this model we take $f_1 \in F$ and $r_1 \in R$.
f_1 will be the making of flyers.
$r_1$will be the CPU speed.

To determine how big the effect of $f_1$will be on the internal requirement, the dialog has to determine how big the desire of the customer is to have this feature. We will determine this using the next graph. The domain of all graphs are $[0,1]$ for the sake of simplicity .

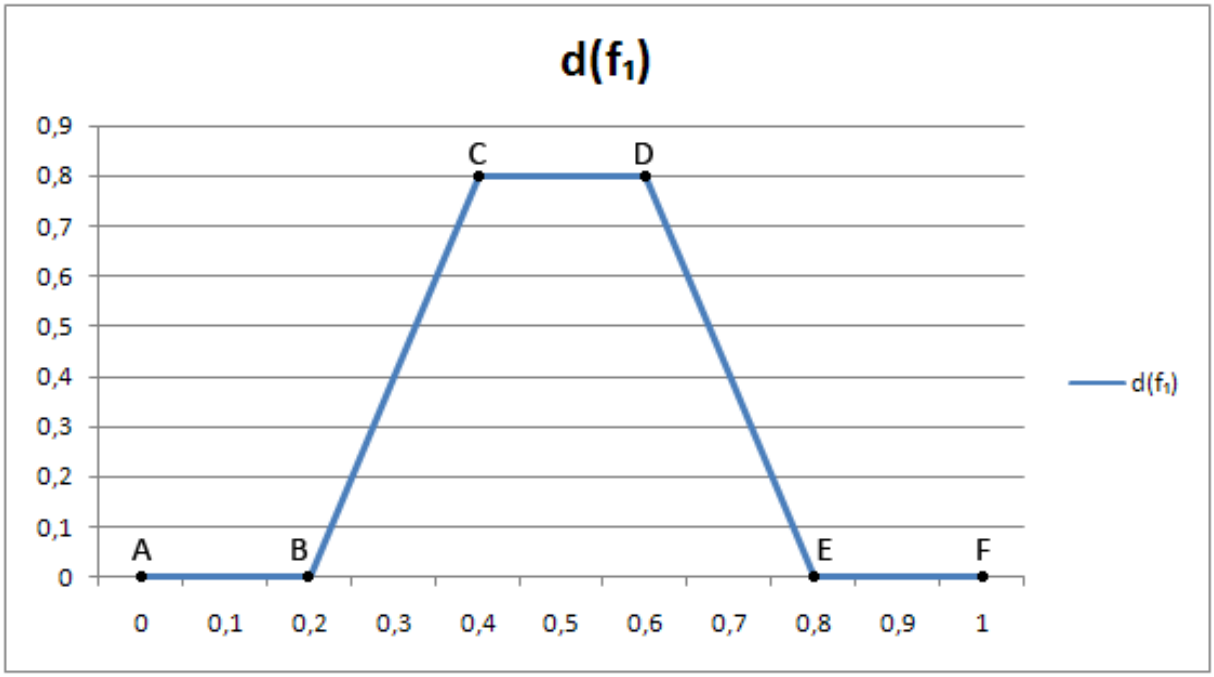

Figure 21. The interest of the customer in the making of flyers

Where d is the interest in f_1.
The graph is divided in sections using letters. The sections will be explained below:

$A \rightarrow B$: The interest is so low, the customer could do the folder by hand.
$B \rightarrow C$: The interest is growing, so the need for a text editor grows to.
$C \rightarrow D$: At this interest level, the text editor provides maximum value for making those flyers.
$D \rightarrow E$: The interest for flyers is getting so great, the value of a text-editor is decreasing.
$E \rightarrow F$: The interest for flyer is so professional, a normal text-editor won't be enough, more professional options are required, e.g. a printing office.

For making flyers we need certain software, like a text editor. This software needs certain hardware, in this case a certain CPU speed. The next graph will link the usability of that text editor to the internal requirements, in this case r_1, the CPU speed.

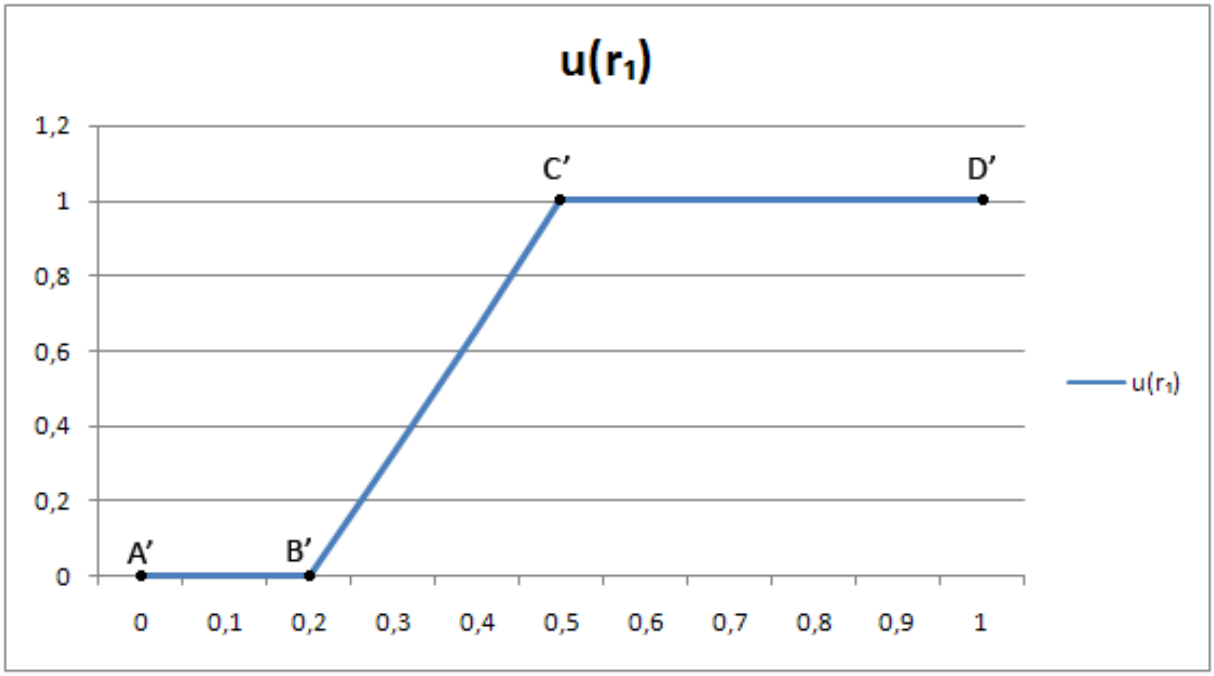

Figure 22. Usability of text editor software based on CPU speed

The higher the value of r_1, the faster the CPU is. The higher the value of u, the higher the usability. Again the graph is divided in sections:

$A' \rightarrow {}'B$: The CPU speed is so low, it cannot run the software needed.
$B' \rightarrow C'$: The usability is growing, but still not optimal.
$C' \rightarrow D'$: The CPU speed is powerful enough to fully use the software.

The goal now is to combine the 2 diagrams above. The dialog needs a diagram that relates F to R, as in this case the making of flyers to CPU speed.
We currently have:

$$f_1 \rightarrow d$$
$$r_1 \rightarrow u$$

Where d and u are in the same domain. Therefore we will take those together:

$$f_1 \rightarrow d = u \rightarrow r_1$$

This results in:

$$r_1(f_1) = u^{-1}(d(f_1))$$

To draw this graph we need to combine the previous two. The two previous graphs are shown combined below. Using this we can deduce the new graph.

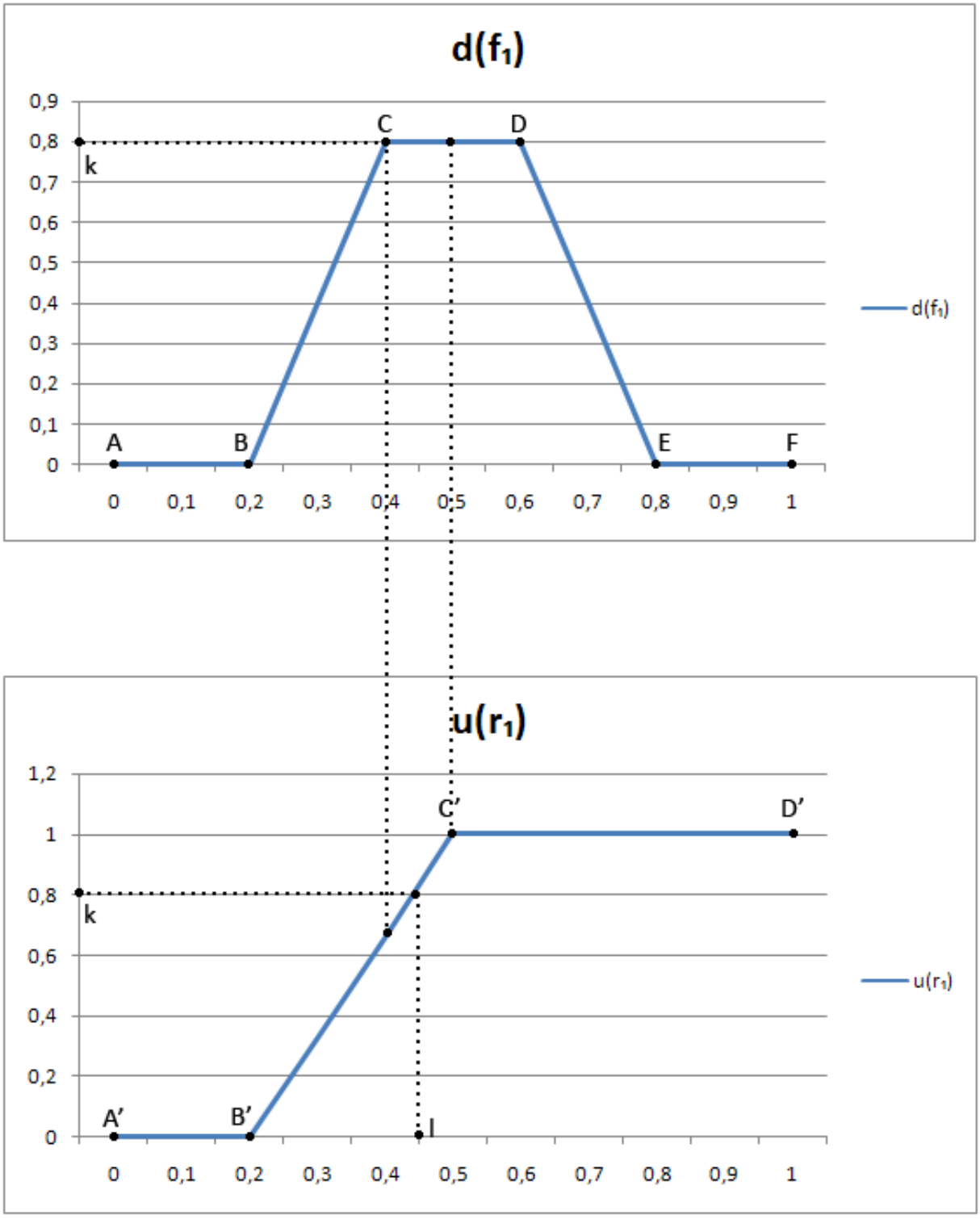

Figure 23. Both graphs combined

The graph we want is the one that links the interest in a feature (f_1) to the internal requirement (r_1). The combined graph is shown below (figure 24):

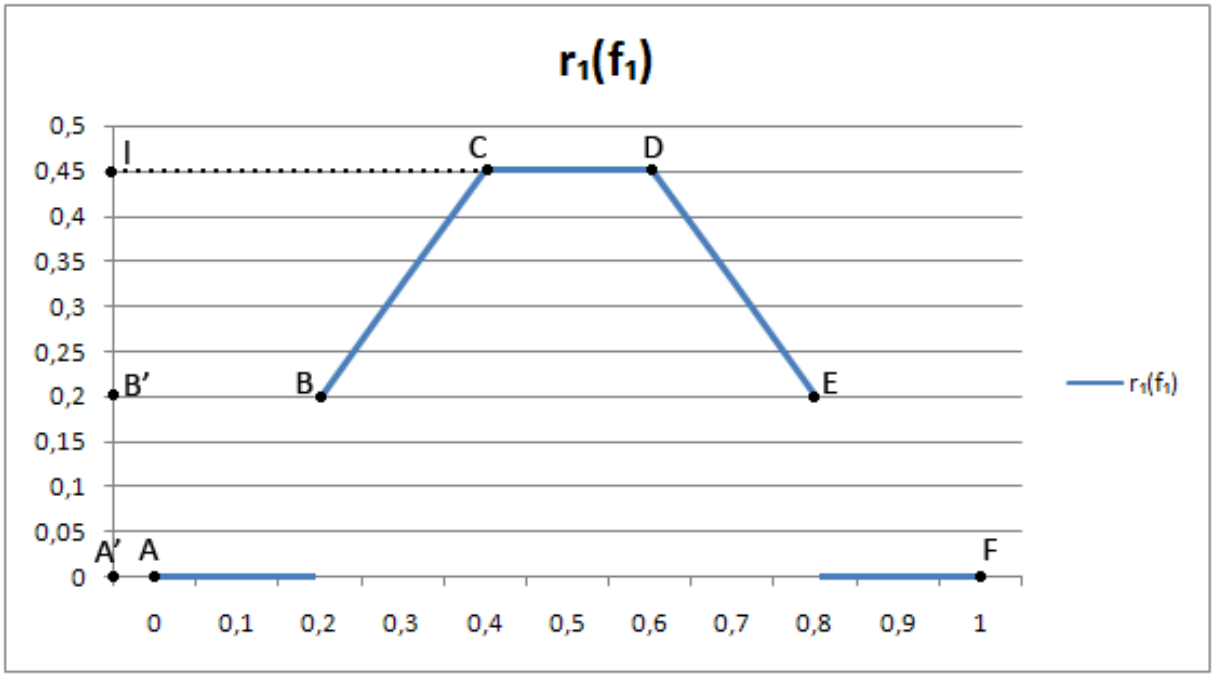

Figure 24. Graph relating f_1 to r_1

To explain this graph we look to the two previous graphs. For points $A \rightarrow B$ the required CPU speed is zero, because there is no requirement for any software, the interest was too low. Same goes for $E \rightarrow F$, where the interest was to professional. The next point will then be B, B', point B is where the customer is getting an reasonable interest in the feature, whereas B' is the minimum CPU speed to be able to run the software needed for feature f_1. At point C the interest of the customer has reached its maximum. The CPU speed related to that is l, this is deducted out of figure 23, and is the speed which is sufficient for the customer's interest level.
l is deducted by looking at the interest level of the customer at point C, which is the value k. Then in the usability graph it is looked up which CPU speed relates to point k, which we call point l. The line between B and C has a steepness of:

$$\frac{l - B'}{C - B}$$

Since the interest level of the customer is constant till D, so is the required CPU speed. The interest then declines, till point E, with the negative steepness mentioned above. Point E is the minimum CPU speed requirement to run the software again, B'.

Now we have this graph we can see how the interest of the customer in feature f_1 relates to the internal requirement r_1. The goal is now to expand this model. Next we will increase the model to encompass 2 features and 2 independent internal requirements. Which means that the features are related to only 1 internal requirement.

We take $f_1, f_2 \in F$ and $r_1, r_2 \in R$. The dialog then has to determine:

$$r_1(f_1)$$
$$r_2(f_2)$$

This is the same process as we have done above, only we need to repeat the process twice. Once for the first feature and requirement, and again for the second feature and requirement. This will result

in two graphs, which enables the dialog to determine both requirements given the interest in both features.

The next step is to use 2 features and 2 internal requirements which are dependant of each other. We take $f_1, f_2 \in F$ and $r_1, r_2 \in R$. The dialog then has to determine:

$$r_1(f_1)$$
$$r_1(f_2)$$
$$r_2(f_1)$$
$$r_2(f_2)$$

We now get two measures for each internal requirement, which is not wanted. The dialog needs a single way to determine what internal requirement is needed. Therefore we need to combine them together.
First we will calculate each of the four graphs. Then we have to combine the graphs belonging to requirement r_1. Each of the graphs shows the minimum internal requirement needed to be able to use that feature, given the interest of the customer in that feature. We then have to determine the internal requirement for both of the features. Given the interest in those features, we can determine that using the graphs. Then we have two values for each of the internal requirements. This is where fuzzy logic comes in. We need the highest internal requirement from both, since it then is sufficient for both features. The fuzzy OR is defined as follows:

$$x\ OR\ y = maximum\big(truth(x), truth(y)\big)$$

So we need to take $r_1(f_1)\ OR\ r_1(f_2)$, this results in the maximum value of those two. So when used, the internal requirement r_1 would be sufficient enough for either f_1 and f_2.

6.2.3.3 Third step

After the second step we have a way to get from the interest in features to the internal requirements. Together with the first step where that interest is asked, we can determine the internal requirements needed. The dialog also has access to a product database where all products are listed with their internal requirements. With the use of a simple similarity algorithm it can then be decided which product(s) resemble the internal requirements the most. These products then can be proposed to the customer. Since this is also a known algorithm, discussed properly in other papers (Taylor, 1968), it will not discussed here further.

6.3 Conclusion

The models shows that there is a way for the dialog to get from a-technical features, which the customer can describe to the technical internal requirements, which can be used to select products. Since it uses basic techniques like case based reasoning, fuzzy logic and basic mathematics it is not hard to create a dialog manager who can control a dialog using this model. The next chapter will via a proof of concept show the viability of this model.

7 Proof of concept

The goal of this chapter is to show via a proof of concept that the model described in chapter 6 is viable, and that it can be used to improve the e-sales dialog. The proof of concept will consist of an example interaction with the dialog, showing how the model handles it, and how it improves the communication with the customer.

7.1 Presenting the proof of concept

For the proof of concept we consider a customer with a vague need. For this example we take as complex product the computer. The customer is looking for a computer, but he doesn't know which kind he needs. He has certain features he finds important to the product, but has no technical knowledge. The customer will surf to the e-store and get confronted with the dialog.

The product chosen for this proof of concept is the computer, this because of its technical base, and that it is a complex product. Also it modular design makes it a good example, and makes it also a very suited product to sell online. The proof of concept can be performed with any other complex product, or even non-complex products.

In the model we defined two collections, features (F) and internal requirements (R). Where F is the relevant features retrieved from the customer, and R the internal requirements of the product.
For this proof of concept we take:

$$surfing\ the\ web, photo\ editing, video\ editing\ \in F$$
$$CPU\ speed,\ \ internal\ memory, harddisk\ size\ \in R$$

We choose for 3 features and requirements each because it is sufficient to proof that the model works, and that the work generated by using larger collections is out of the scope of this paper. We also assume that all the features and internal requirements are dependant of each other. So all features are related to all internal requirements.

In the model all graphs have the domain $[0,1]$ for the sake of simplification. Since the graphs now have to relate to real requirements, the domain needs to relate to the real internal requirement values. The tables below show how the values are related for each internal requirement.

0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
1.0 GHz	1.3 GHz	1.6 GHz	2.0 GHz	2.3 GHz	2.6 GHz	3.0 GHz	3.3 GHz	3.6 GHz	4.0 GHz

Table 11. CPU speed related to domain

0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
256 MB	512 MB	768 MB	1024 MB	1536 MB	2048 MB	2560 MB	3072 MB	3584 MB	4096 MB

Table 12. Memory size related to domain

0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
40 GB	80 GB	160 GB	320 GB	500 GB	640 GB	768 GB	1024 GB	1536 GB	2048 GB

Table 13. Hard disk size related to domain

The final outcome of the dialog is the product that fulfils the needs of the customer the best. To achieve this a example population of the product list is needed. That list is provided below, five different computers, each with different internal requirements:

	CPU Speed	Memory size	Hard disk size
Computer 1	1.3 GHz	512 MB	80 GB
Computer 2	1.6 GHz	512 MB	160 GB
Computer 3	2.3 GHz	1024 MB	620 GB
Computer 4	3.3 GHz	2048 MB	1024 GB
Computer 5	4.0 GHz	2048 MB	512 GB

Table 14. Example computer used in the proof of concept

The proof of concept will use the model described in chapter 6 to select a product for the customer.

7.2 Dialog

Here the model described in the previous chapter for customer with vague needs is used. The model consists out of three steps to guide the customer to the product, step one is the selecting of the features the customer deems important. Step two is the combining of the interest in those features with the internal requirements. Step three is using the determined internal requirement to find the product that fits those requirements the best.

7.2.1 First step

Since the customer has a vague need, it ask questions using the case-based reasoning method to find out the features the customer deems important, and what the interest are in those features. Since other papers have described this process in far greater detail then we could do here (Bergmann, Schmitt, & Stahl, 2002) (Schmitt, 2002), we will not discuss the subject any further. The outcome of the first step will be the interest of the customer in the three features. For this proof of concept we take:

$$d(surfing\ the\ web) = 1.0$$
$$d(photo\ editing) = 0.8$$
$$d(video\ editing) = 0.5$$

Meaning the customer is really interested in using the computer to surf in the internet, finds the feature to edit photos relatively important. For video editing the customer deems it an interesting feature, but is not highly interested in it. These values will be used in the second step to derive internal requirements using the graphs.

7.2.2 Second step

In the previous step the model derived the interest of the customer in the features given. Now the model has to relate those features to internal requirements. The model will do this using graphs which will relate the two. First we need an interest diagram for each of the features, these are shown below for each one of the features. For a full size version of the graphs, see Appendix C.

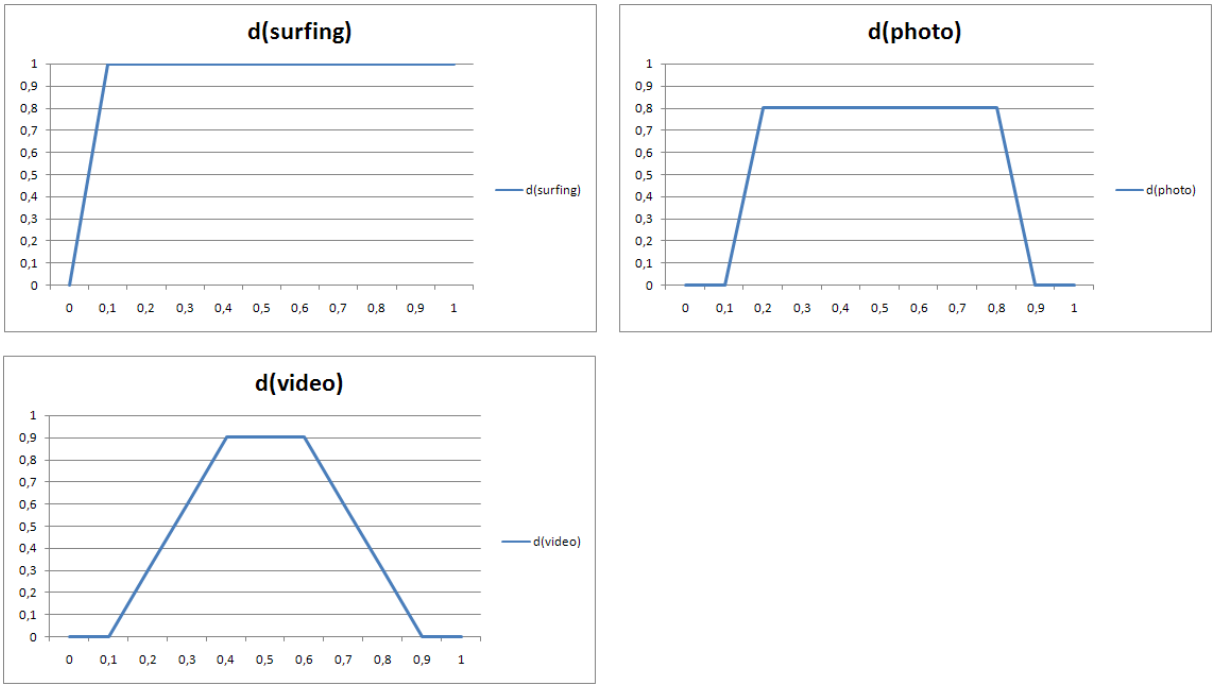

Figure 25. Interest graphs for the features

Figure 25 shows the interest graphs for each of the current features. The goal of the interest graphs is to show how much interest the customer has in a certain feature. Like stated above, for this proof of concept the features are: *surfing, photo editing, video editing*.
The surfing graph shows that if the customer is totally not interested in surfing, he doesn't need anything, but as soon the customer has even a small interest in surfing, the interest graph goes to 1.0. This because even if the customer doesn't surf often, the computer needs to be able to run a web browser.
The photo interest remain 0 in the beginning if the interest is so low that the customer doesn't need an photo editing program, or 0 in the end where the interest for photo editing is so great the customer needs specialized hardware. The video interest graph shows us that it is more gradual, this means that if there is a small interest, the software needed doesn't have to be big, but as the interest grows, more specialised software is needed. If the interest keeps growing, the value of that software decreases, to the point where the customer is better off with a specialized solution.

Since this proof of concepts has three internal requirements, each of the interest graphs is related to three usability graphs. A usability graph shows how well the feature performs given an internal requirement. To create a usability graph we need to identify what is needed to use that feature on the computer. For the first feature, surfing, the computer needs to be able to run a web browser. Figure 26 shows how well the web browser will run given the internal requirement.

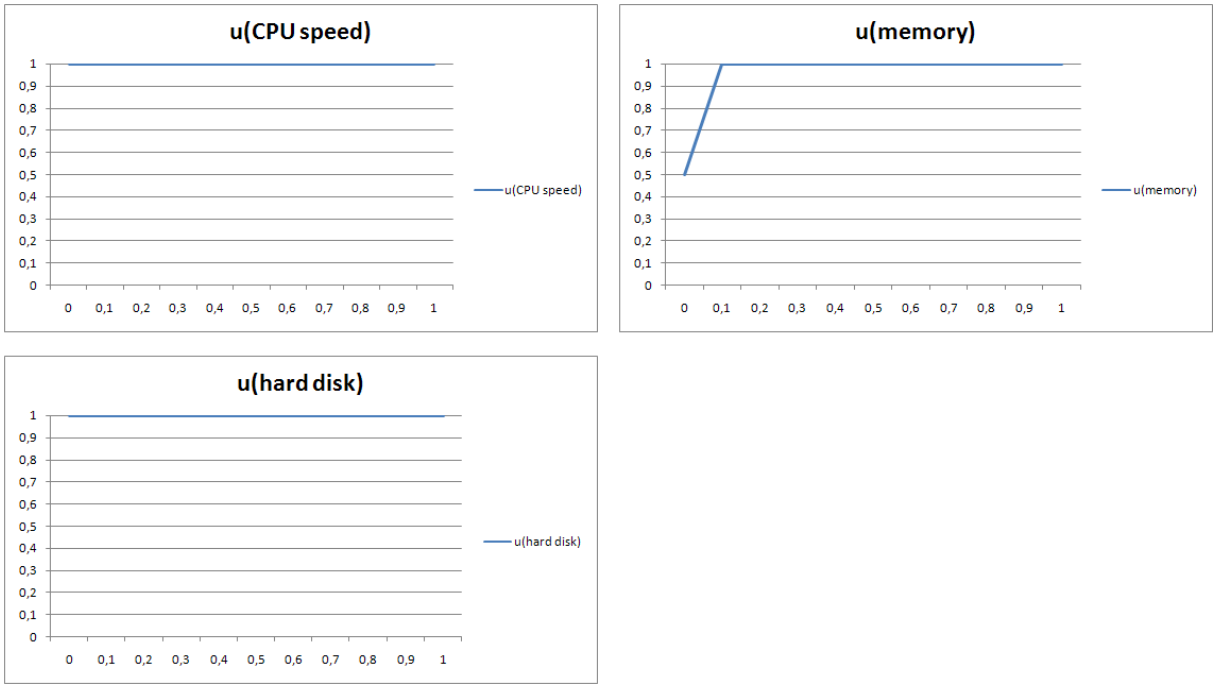

Figure 26. Usability graphs for surfing

Since a web browser is a relative light program to run, even the most basic configuration is able to run the software, only on the minimum amount of memory the usability is not optimal, but grows fast to the optimum.

Since we now have the interest diagram for surfing, and the usability diagrams for each of the internal requirements related to surfing, we can create the graphs that relates the feature to the internal requirements, as shown in figure 27. This graphs relate a feature, surfing, to the internal requirements in R. This way the model can determine the internal requirement when the interest is given.

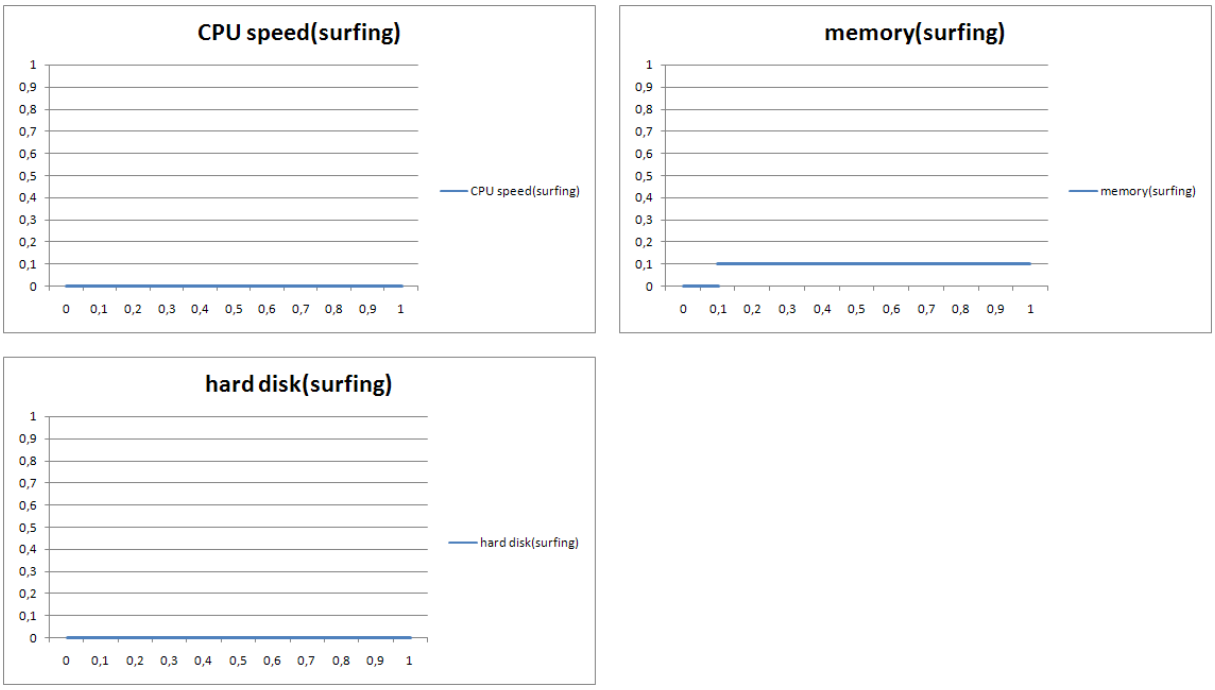

Figure 27. Internal requirements related to surfing

These graphs can provide us with the internal requirements value, since the interest in surfing is given:

$$CPU\ speed_{surfing}\ (1.0) = 0.0$$
$$memory_{surfing}(1.0) = 0.1$$
$$hard\ disk_{surfing}(1.0) = 0.0$$

Now we have to do the same for the other two features. We start with the usability diagrams for photo editing. For photo editing the computer should be able to run photo editing software, so the usability graphs are based on that.

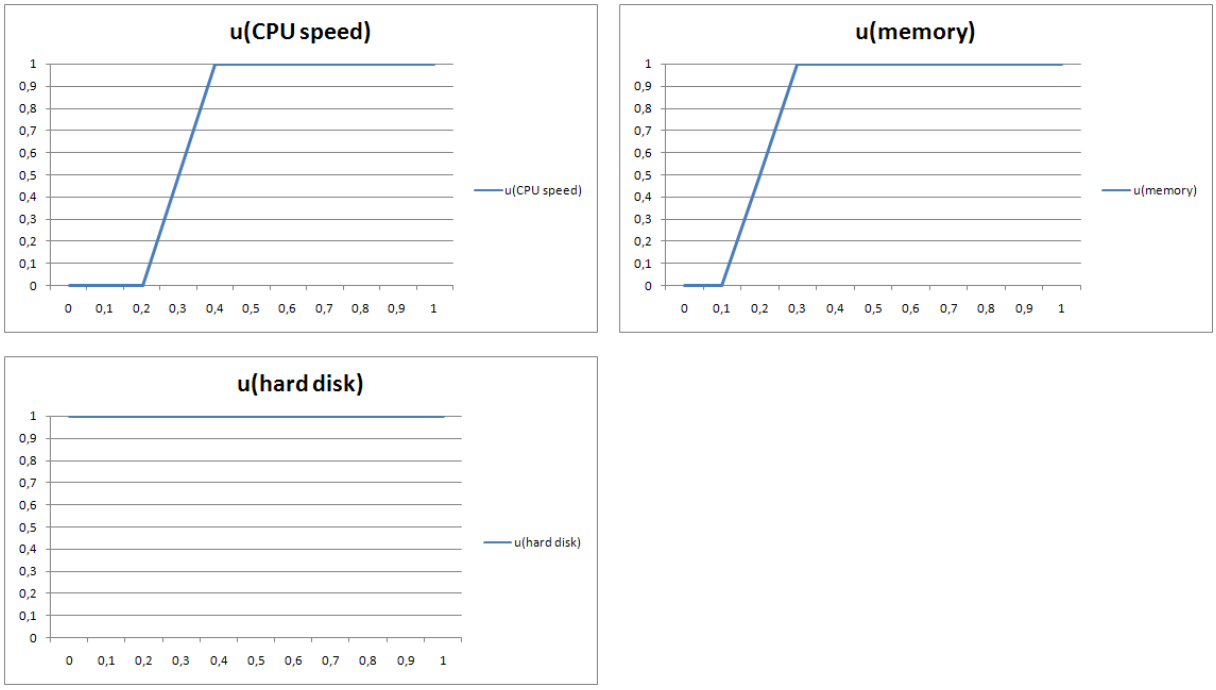

Figure 28. Usability graph for photo editing

CPU speed and memory size have a modest effect on how the photo editing software runs, the minimum configurations for CPU speed and memory size aren't sufficient to run the software, but it grows fast to the optimum. Whereas hard disk size has no effect on the performance of the software, the minimal size of the hard disk is enough for optimum performance.

With these graphs we can create the graphs that link the photo editing feature to the internal requirements as shown in figure 29.

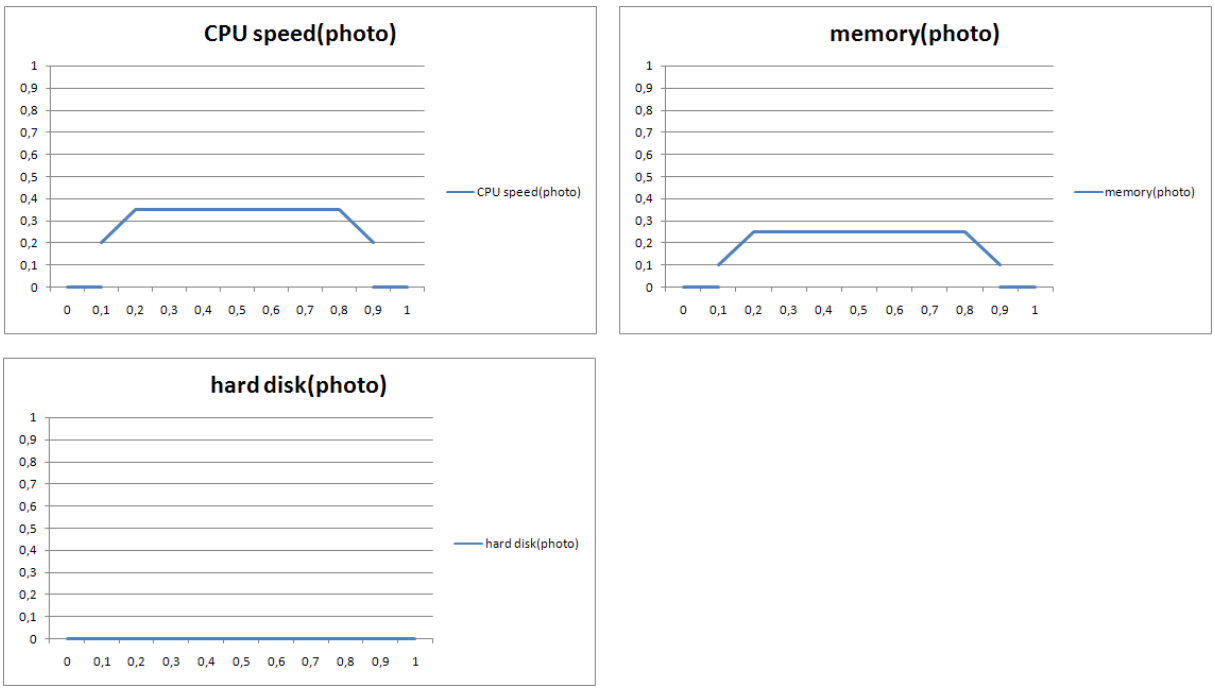

Figure 29. Internal requirements related to photo editing

With these graphs and the given interest in photo editing we can determine the internal requirements for this feature:

$$CPU\ speed_{photo}\ (0.8) = 0.35$$
$$memory_{photo}(0.8) = 0.25$$
$$hard\ disk_{photo}(0.8) = 0$$

Now only the feature video editing remains. The usability graphs are based on video editing software, since that is used to edit videos.

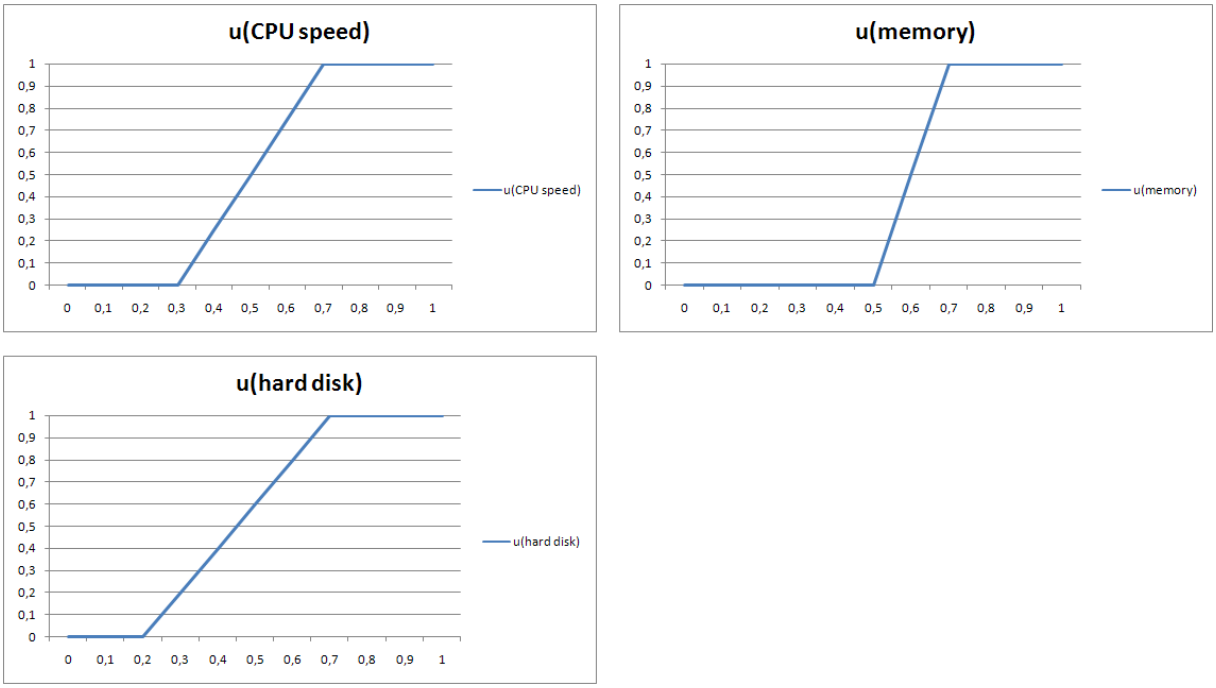

Figure 30. Usability graph for video editing

Figure 30 shows the usability for each internal requirement for video editing. It clearly shows at once that video editing is much more intensive for a computer, and therefore requires relativity good internal requirements to run it at full usability.

Again we can combine both graphs to relate video editing to the internal requirements:

Figure 31. Internal requirements related to video editing

With the given interest in video editing, the internal requirements are:

$$CPU\ speed_{video}\ (0.5) = 0.65$$
$$memory_{video}(0.5) = 0.675$$
$$hard\ disk_{video}(0.5) = 0.65$$

To determine the internal requirements the product should have, we now take the fuzzy OR on each internal requirement for each of the features. The fuzzy OR takes the maximum of the three values. This makes sure that the internal requirement is sufficient enough for all three of the features.

$$CPU\ speed_{total} = CPU\ speed_{surfing}\ OR\ CPU\ speed_{photo}\ OR\ CPU\ speed_{video}$$
$$CPU\ speed_{total} = 0.0\ OR\ 0.35\ OR\ 0.65$$
$$CPU\ speed_{total} = 0.65$$

$$Memory\ size_{total} = Memory\ size_{surfing}\ OR\ Memory\ size_{photo}\ OR\ Memory\ size_{video}$$
$$Memory\ size_{total} = 0.1\ OR\ 0.25\ OR\ 0.675$$
$$Memory\ size_{total} = 0.675$$

$$Hard\ disk\ size_{total} = Hard\ disk\ size_{surfing}\ OR\ Hard\ disk\ size_{photo}\ OR\ Hard\ disk\ size_{video}$$
$$Hard\ disk\ size_{total} = 0.0\ OR\ 0.0\ OR\ 0.65$$
$$Hard\ disk\ size_{total} = 0.65$$

7.2.3 Third step

In the third step the dialog selects which product or products resemble the internal requirements calculated at step 2 the best. First we need to translate the values for each of the internal requirements back to their respective value. We therefore use the tables mentioned in 7.1:

0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
1.0 GHz	1.3 GHz	1.6 GHz	2.0 GHz	2.3 GHz	2.6 GHz	3.0 GHz	3.3 GHz	3.6 GHz	4.0 GHz

Table 15. CPU speed related to domain (from 7.1)

0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
256 MB	512 MB	768 MB	1024 MB	1536 MB	2048 MB	2560 MB	3072 MB	3584 MB	4096 MB

Table 16. Memory size related to domain (from 7.1)

0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
40 GB	80 GB	160 GB	320 GB	500 GB	640 GB	768 GB	1024 GB	1536 GB	2048 GB

Table 17. Hard disk size related to domain (from 7.1)

To calculate the internal requirements, we look them up in the tables above, and take the value closest to it. This results in:

$$CPU\ speed_{total} = 0.65 \approx 3.0\ GHz$$
$$Memory\ size_{total} = 0.675 \approx 2560\ MB$$
$$Hard\ disk\ size_{total} = 0.65 \approx 768\ GB$$

Now we have the internal requirement values we need. We take the table of example computer from 7.1. A simple information retrieval algorithm can select the product that resembles these values the most. This has been discussed plenty in other papers (Taylor, 1968), so we won't discuss it further here. Since this example population is so small, it is easy to see that Computer 4 resembles the internal requirements the most, this would then be a good choice for the dialog to offer to the customer.

	CPU Speed	Memory size	Hard disk size
Computer 1	1.3 GHz	512 MB	80 GB
Computer 2	1.6 GHz	512 MB	160 GB
Computer 3	2.3 GHz	1024 MB	620 GB
Computer 4	3.3 GHz	2048 MB	1024 GB
Computer 5	4.0 GHz	2048 MB	512 GB

Table 18. Example computer used in the proof of concept (from 7.1)

7.3 Conclusion

This proof on concept based on the model presented in chapter 6 shows that the model is viable. Using questions to find the interest of the customer in the features, and use those to relate them to internal requirements is a process which can be handles by an digital agent. The customer doesn't have to be confronted with the technical requirements, while still getting the product that fulfils his need. Although this proof of concept was limited in means of features, internal requirements and example products, it is not hard to scale it up. A point for further research would be how this model would behave in a real world example.

8 Conclusion

The goal of this these was to improve the e-sales dialog for complex products. To achieve this goal the thesis was divided in six sections. First the current techniques where discussed, these techniques have a very theoretical basis, and it was not sure if they would be any use in improving the e-sales dialog. Of the four techniques discussed, three were used in creating the model that would improve the e-sales dialog. Case-based reasoning is used for creating a question database and to create an algorithm to select the questions that would bring maximum information gain for the dialog. Fuzzy reasoning is used to take features graphs together when opposed with multiple features to determine the internal requirement value. The user model is used to create a model of the customer, this model was used to create the dialog manager model, which uses the user model to determine what to expect from the customer.

To be able to improve the e-sales dialog, a better understanding of complex products was needed. Therefore it was attempted to define complex products using 2 axles, complex to buy and complex to use. Although it was hard to distinguish between to the axles, it gave us a handle to classify four kinds of complex products. This then could be used by the e-sales dialog to determine the approach needed given the type of complex product the dialog was trying to sell.
To get a better idea of how dialogs work, a real life example was used, the dialog of Dell.com. To understand the company better, a small casus about Dell was written to get background knowledge. The dialog used by Dell showed some interesting properties, this combined with findings in papers researched in the first chapter showed that the dialog was too complex to serve customers that didn't have background knowledge of the product.
To be able to interpret those findings, a small market research was performed. This market research consisted of a questionnaire that covers the buying of products online. The respondent group consisted out of 27 people, who answered questions about buying products online, and what they thought were the strong and weak points of the current dialogs they are confronted with. This provided an insight in how customers approach the buying online. Many customers use the internet only for explorative purposes, where they afterwards till buy the product in an offline shop.
With the data retrieved from the customer research a user model could be created. This model consisted out of an UML schema consisting of use-cases. These showed the actions a customer would undertake when buying online.
With all the data combined from the previous chapters a model for the dialog manager was derived, the goal of this model was to improve the sales for complex products. The model started with a customer which had a vague need and it would end with a product that would fulfil the need of that customer. The model consists out of three steps. The first step determine which features of the products the customer deems important. The second step is to translate the interest in those features to the internal requirements of the products. The third step then is to find the product from the product list that resembles the found requirements the most.
This model was then proven valid using a proof of concept, which used as example products computers, since these are a good example of complex products which have a good future of being sold online.
The model shows how a successful e-sales dialog should be created, and which demands it should meet. The model therefore gives a handle so current e-sales dialogs can be improved, and therefore sales online for complex products can be improved.

8.1 For further research

The model which tries to classify complex products is maybe to distinct. A third property, price, could be introduced so a three-dimensional model could be presented to classify complex products. This because the price has a significant effect on the selling of the product online. The market research was performed with a limited respondent group. To get better results the market research could be repeated with a larger respondent group. The model created is proven via proof of concept, an interesting subject for further research would be to prove the model using it in a real life example.

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Appendix A

This appendix contains the process a customer goes through when buying a computer at dell.com. The dialog is shown step by step through screenshots. The screenshots were taken on 7 January 2008 from the American Dell site (www.dell.com).

A.1 Selecting a desktop computer

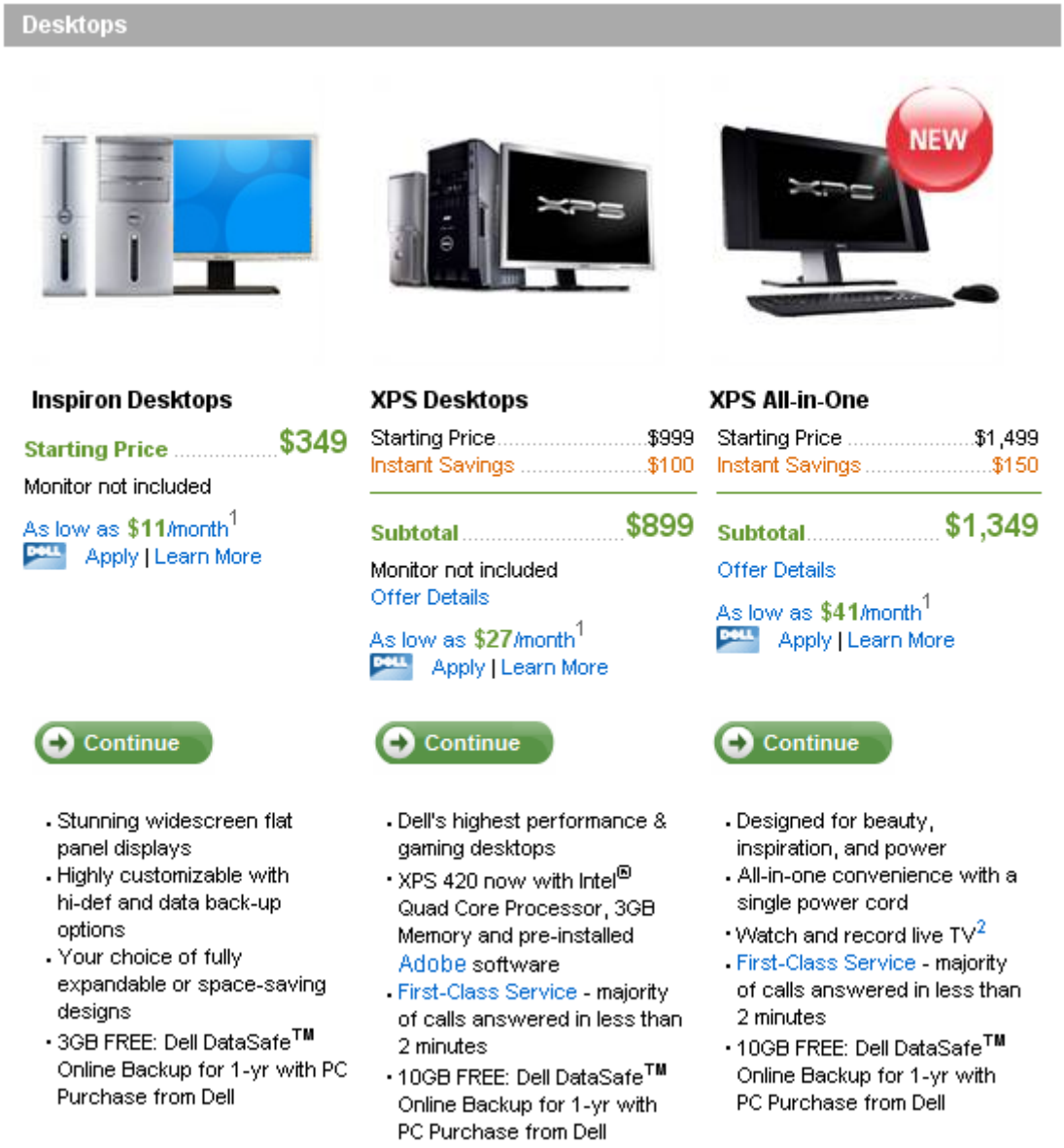

Figure 32. Selecting a desktop computer

A.2 Inspiron desktop selection

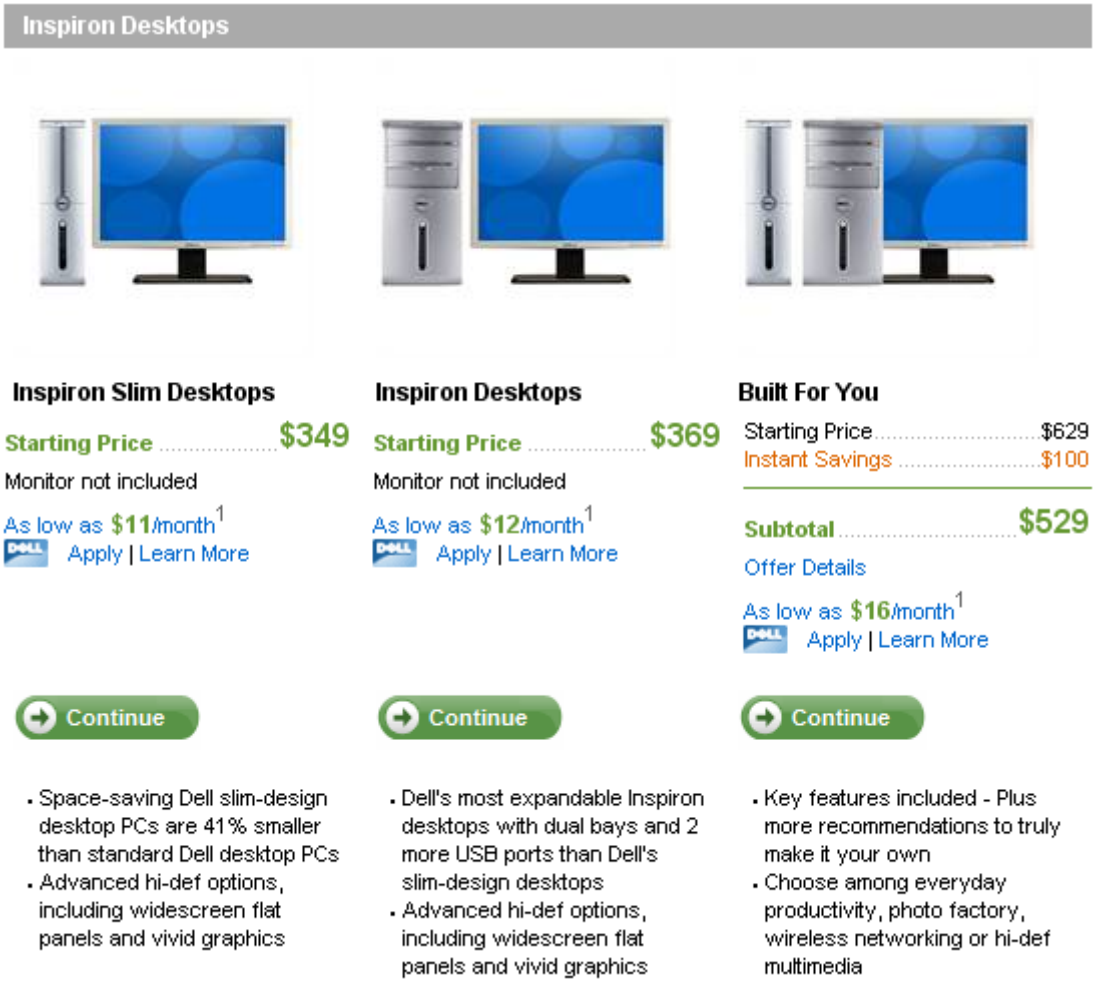

Figure 33. Inspiron desktop selection

A.3 Featured systems

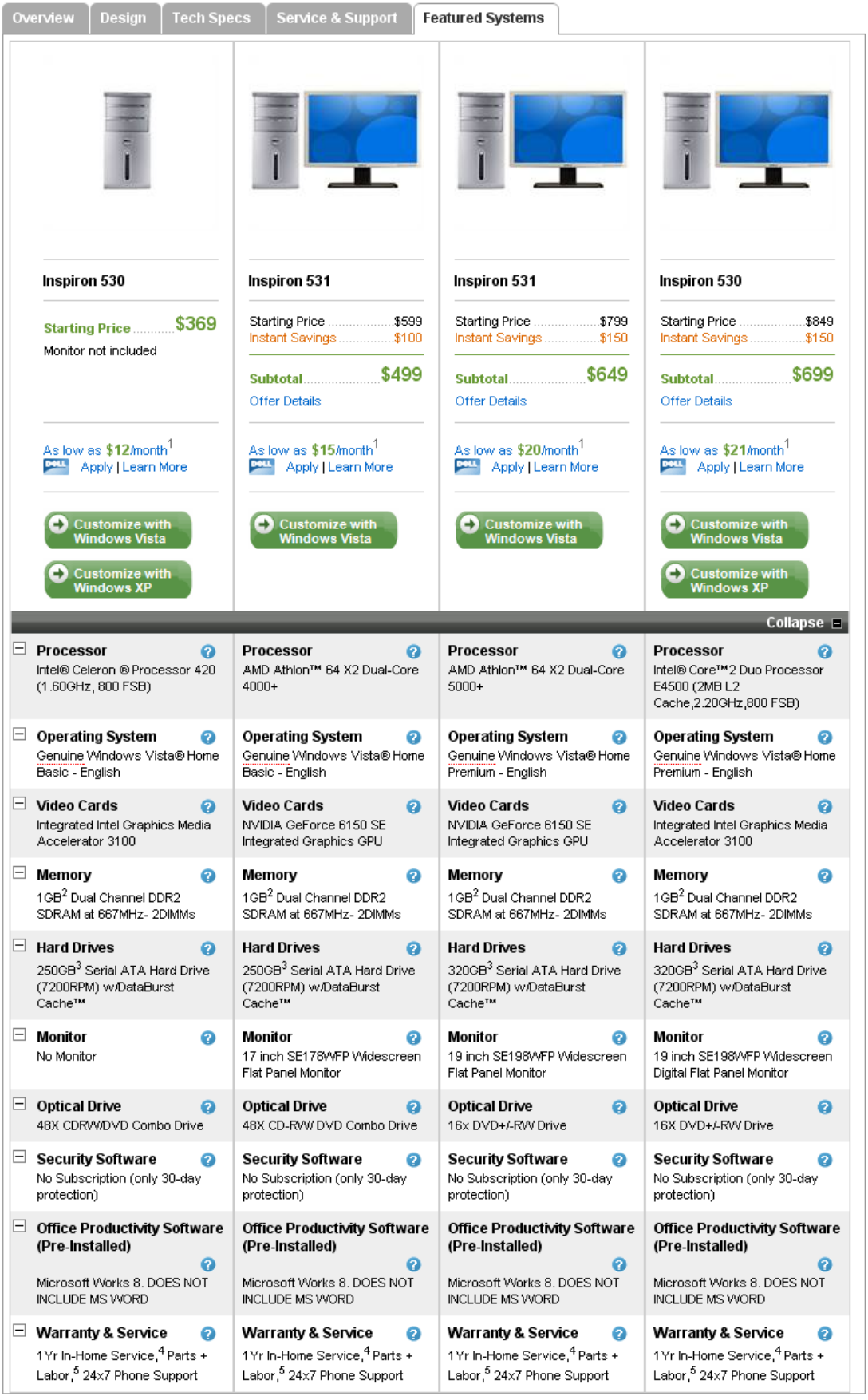

Figure 34. Featured Systems

A.4 Select protection

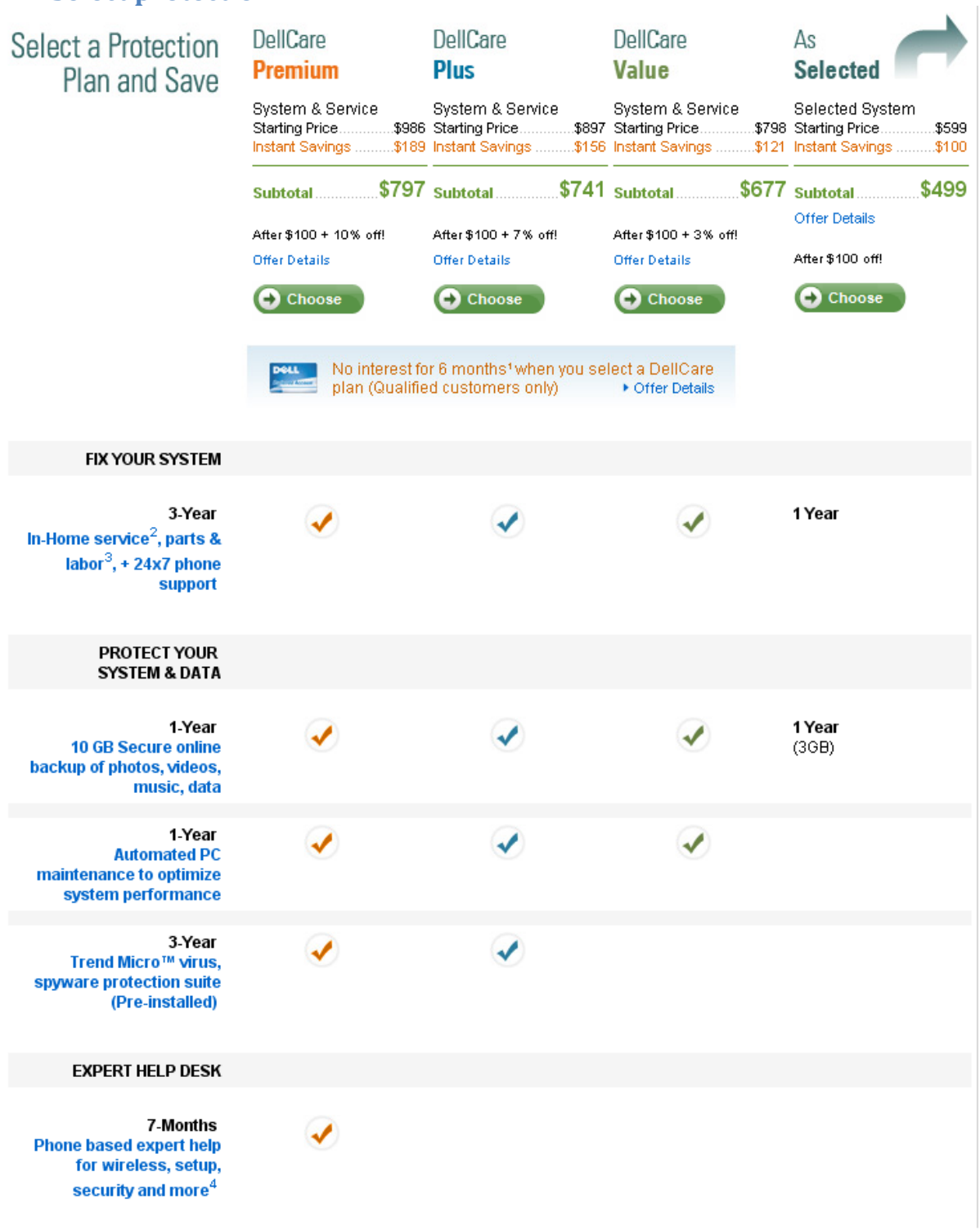

Figure 35. Select protection

A.5 Select features

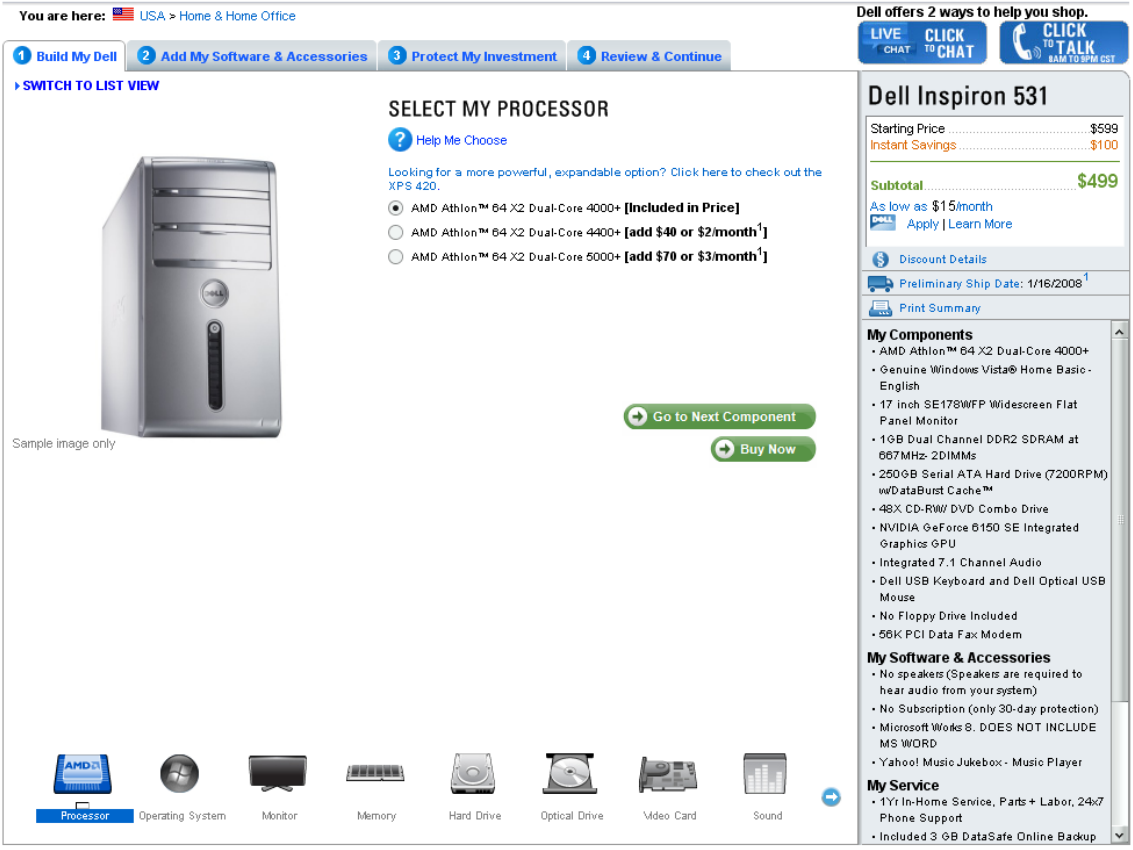

Figure 36. Selecting features 1

Figure 37. Selecting features 2

A.6 Help me choose

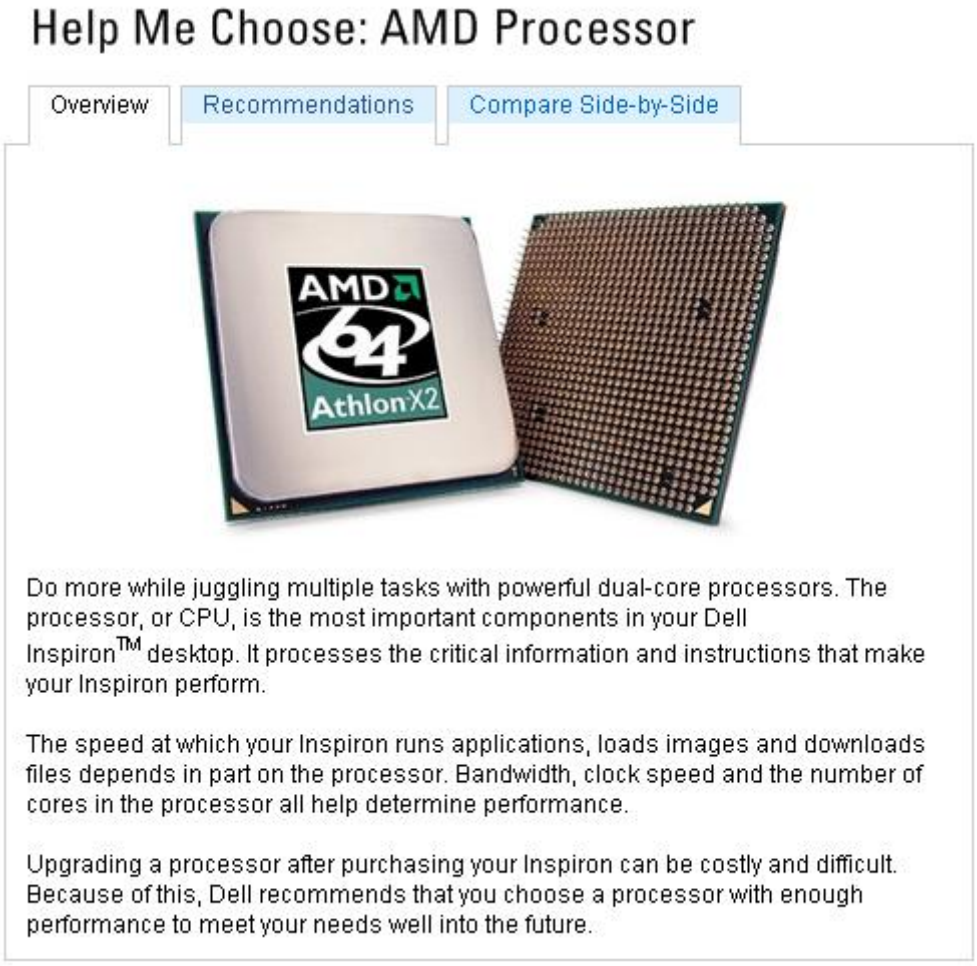

Figure 38. Help me choose: AMD processor, tab 1

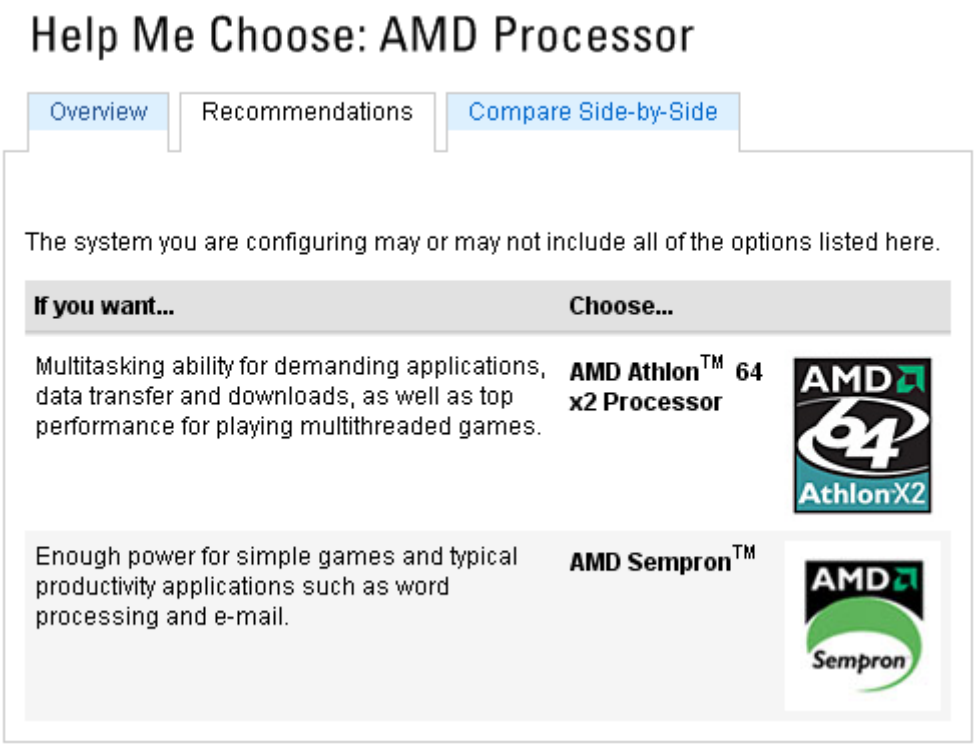

Figure 39. Help me choose: AMD processor, tab 2

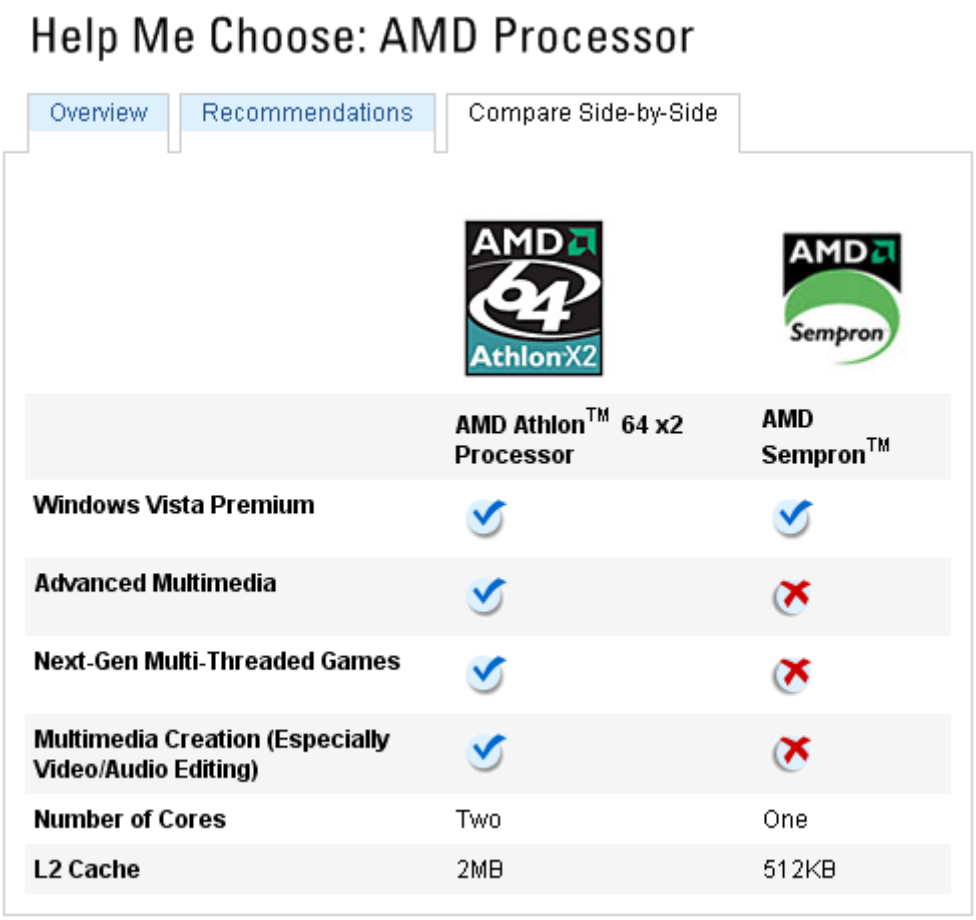

Figure 40. Help me choose: AMD processor, tab 3

A.7 Select accessories

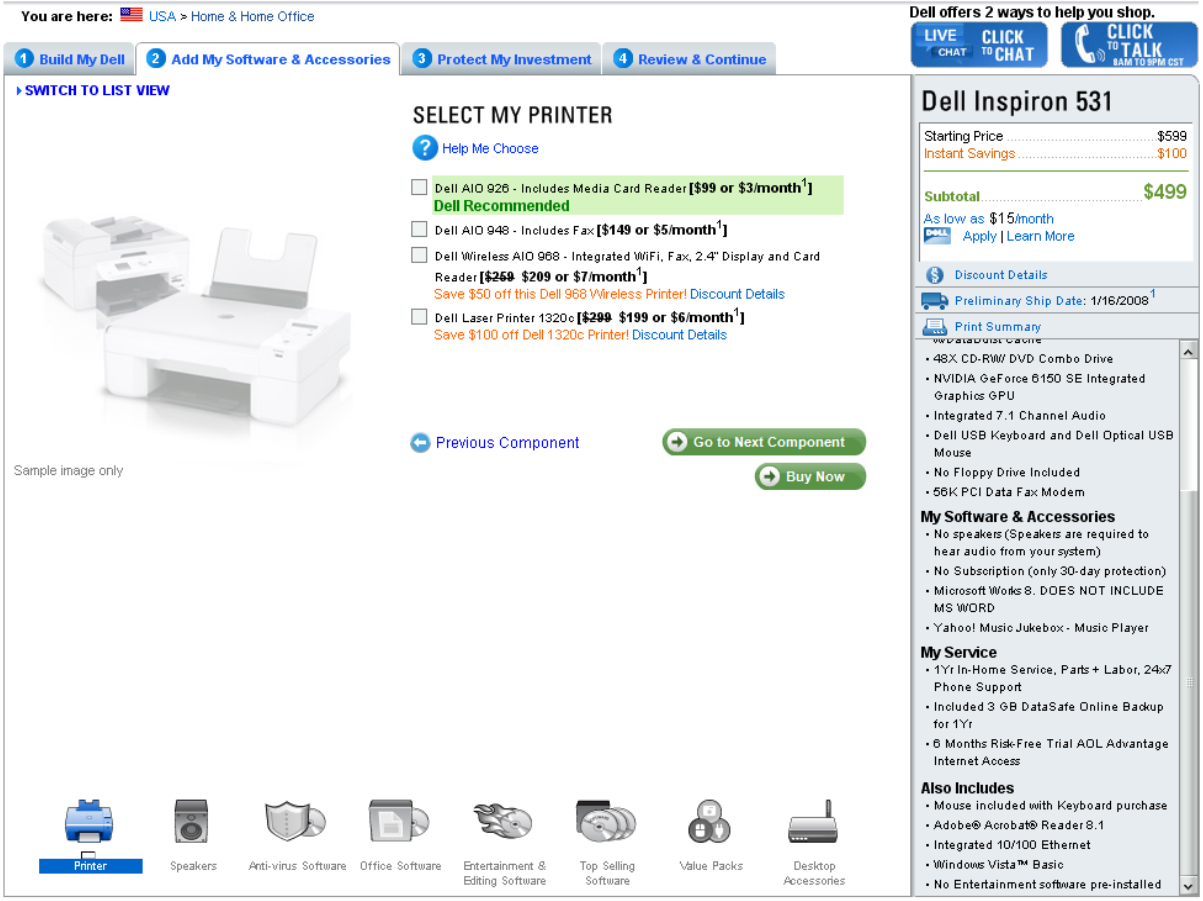

Figure 41. Select accessories

A.8 Select Warranty

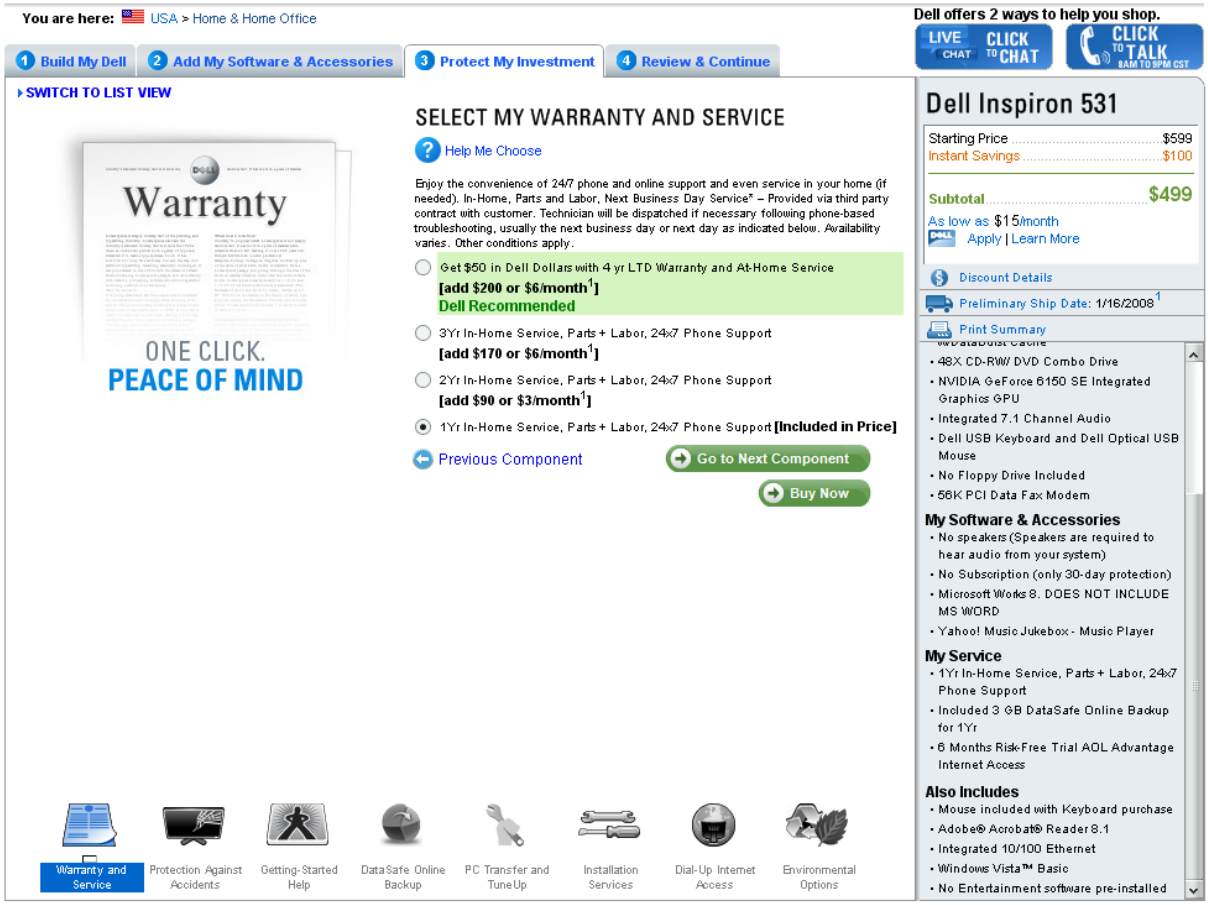

Figure 42. Select Warranty

A.9 Review the product

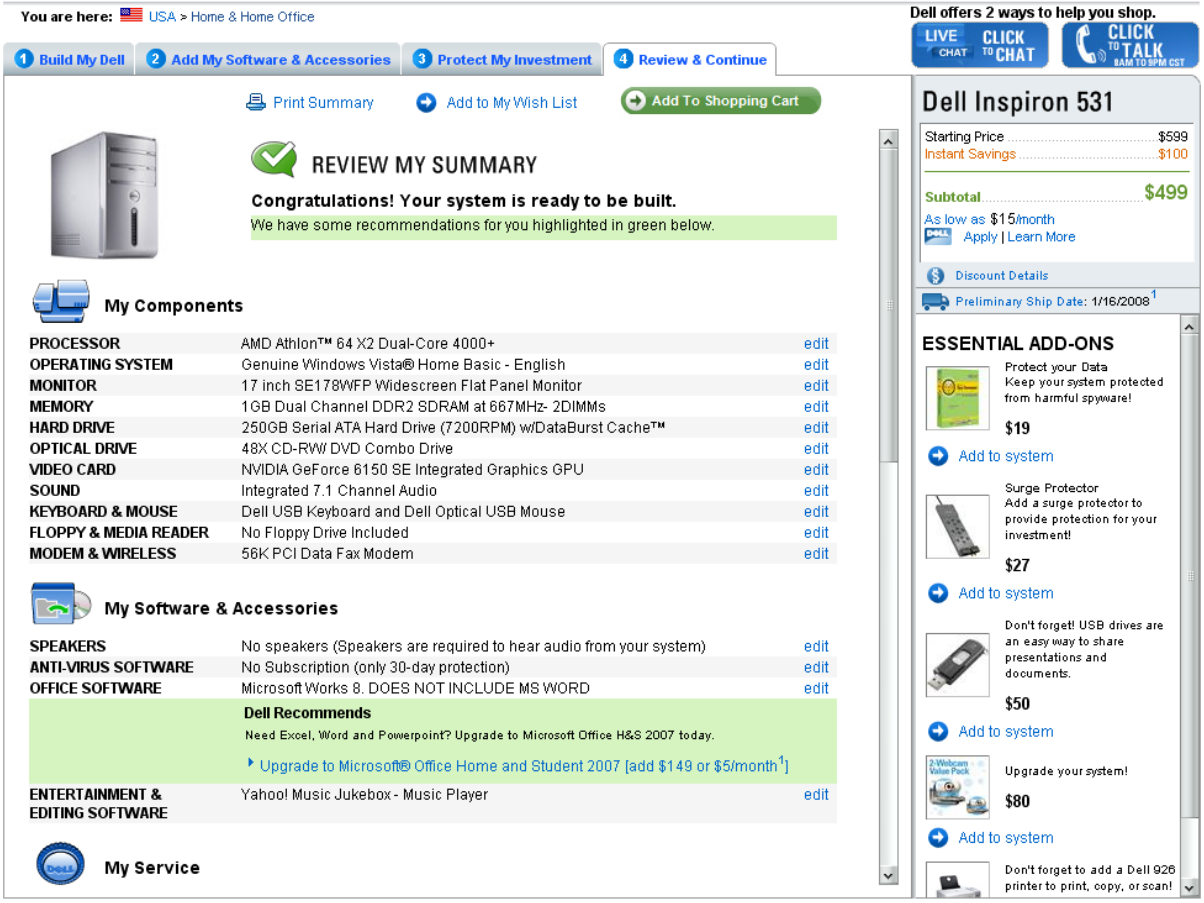

Figure 43. Review the product

Appendix B

This appendix contains the interview used for customer research in chapter 4. Since the interviews were taken in the Netherlands, their language is in Dutch.

B.1 Questionnaire

Deze vragenlijst is onderdeel van mijn afstudeerproject in de studie informatica en heeft tot doel inzicht te krijgen over de verkoop van complexe producten via Internet. Tevens wil ik met behulp van de vragenlijsten antwoord krijgen op de vraag hoe verkoop via Internet zo dicht mogelijk bij de verkoop in een echte winkel kan komen te liggen, bijvoorbeeld door gebruik te maken van dialogen. Probeer de open vragen zo uitgebreid mogelijk in te vullen, zodat ik er zoveel mogelijk informatie uit kan halen.
De vragen zijn multiple choice waar mogelijk, omcirkel wat voor u van toepassing is, **meerdere antwoorden zijn mogelijk**. Bij sommige vragen word er ook nog een toelichting gevraagd, vul deze dan ook in.
Neemt u de tijd om deze vragen serieus in te vullen. Bij voorbaat dank voor uw medewerking.

Leeftijd: ……
Plaats: ……..
Geslacht: *man / vrouw*

1. Schaft u wel eens producten aan via het Internet (via webshops bijv, bol.com, neckerman, free recordshop, etc)?
   ja / nee

   Zo nee, waarom schaft u geen producten aan via het Internet?
   Moeilijkheidsgraad / prijs / beschikbaarheid / betrouwbaarheid / anders

   Toelichting:
   ……
   ……
   ……
   ……
   ……

   Indien u bij vraag 1 *nee* heeft geantwoord, ga verder met vraag 8.

2. Zo ja, hoe vaak ongeveer per jaar?
   …… keer

3. Wat geeft u gemiddeld uit per keer dat u aankopen doet op het Internet?
   €0-€20 / €20-€50 / €50 - €100 / €100 - €250 / €250 - meer

(Denk bij de beantwoording van de volgende vragen aan de website die u het vaakst heeft gebruikt voor het doen van aankopen via Internet)

4. Als u producten koopt via het Internet, met wat voor interface wordt u dan geconfronteerd? De interface is de manier waarop de website de gegevens aan u toont. Dit kan zijn via een lijst met producten onder elkaar. Of dat na het geven van een zoekterm of het selecteren van een producttype een lijst van geselecteerde producten wordt weergegeven. Of door middel van een, die via een uitgebreide vragenlijst bepaald welk product u zoekt.

   Lijst van producten / Eerst zoekterm of product type, dan een lijst van geselecteerde producten / via een uitgebreide vragenlijst wordt een kleine selectie producten getoond / anders

   Toelichting:
   ……
   ……
   ……
   ……
   ……

5. Noem drie zaken die U bijzonder prettig en handig vindt in het gebruik van deze website
   ……
   ……
   ……
   ……
   ……

6. Noem 3 zaken die u onprettig en onhandig vindt bij het gebruik van deze website.
   ……
   ……
   ……
   ……
   ……

7. Van welke websites maakt u nog meer gebruik om aankopen te doen op het Internet?
   ……
   ……
   ……
   ……
   ……

8. Wat vindt u de pluspunten van het kopen via Internet?
   ……
   ……
   ……
   ……
   ……

9. Wat vindt u de minpunten van het kopen via Internet?
   ……
   ……
   ……
   ……

10. Geef hieronder aan welke soort producten u al eens via Internet heeft gekocht of bij gelegenheid waarschijnlijk via Internet zou aanschaffen? (omcirkelen wat van toepassing is)

    Boeken / films / mp3-speler / kleding / software / cursussen / computers / camera's / …

    Anders, namelijk:
    ……
    ……
    ……
    ……
    ……

11. Sommige producten zijn lastiger te verkopen op het Internet dan andere producten. Welke producten lijken u lastig te (ver)kopen via het Internet? En waarom?
    ……
    ……
    ……
    ……
    ……

12. Hoe gaat u te werk als u een product wilt kopen, waarvan u niet voldoende kennis heeft om het onmiddellijk aan te schaffen (bijvoorbeeld fotocamera of geluidsinstallatie), of waarvan u niet precies weet welke eigenschappen u nodig heeft (een computer)? Zoekt u informatie op Internet? Koopt u het daarna via Internet of toch in een gewone winkel? Of koopt u het product in overleg met een verkoper?
    ……
    ……
    ……
    ……
    ……
    ……

13. Wat zou U er toe brengen om vaker artikelen via het Internet kopen?
    ……
    ……
    ……
    ……
    ……

B.2 Graphs

A collection of the graphs used in the thesis which were derived from the questionnaire.

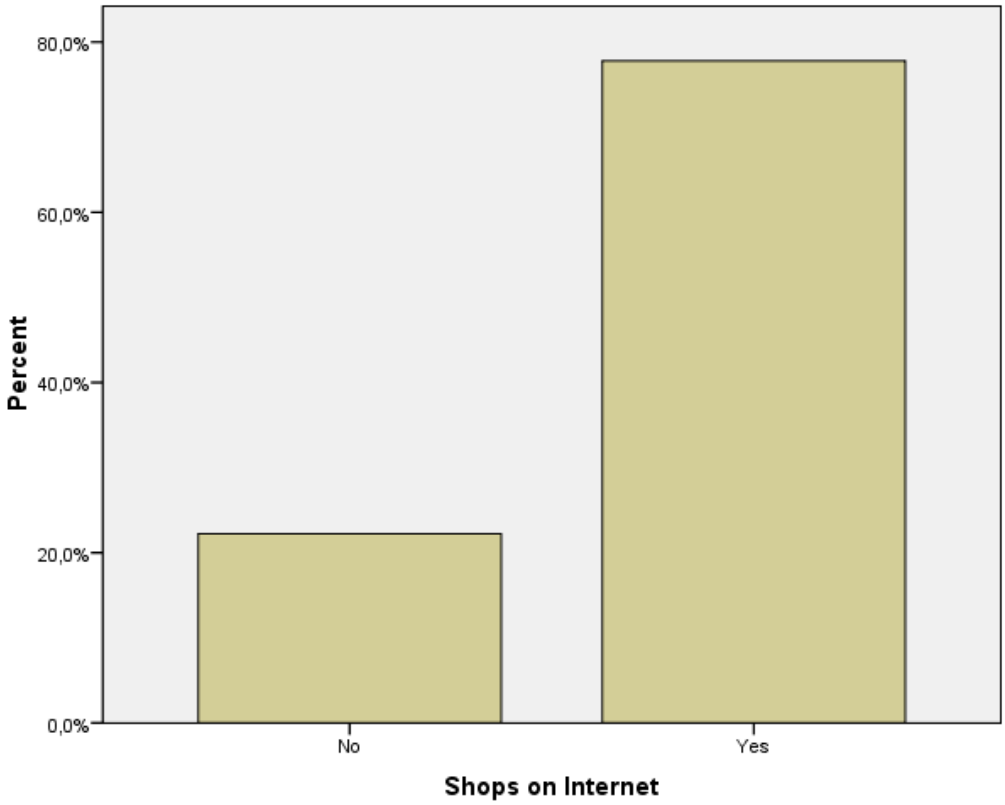

Figure 44. Percentage of respondent group that shops online

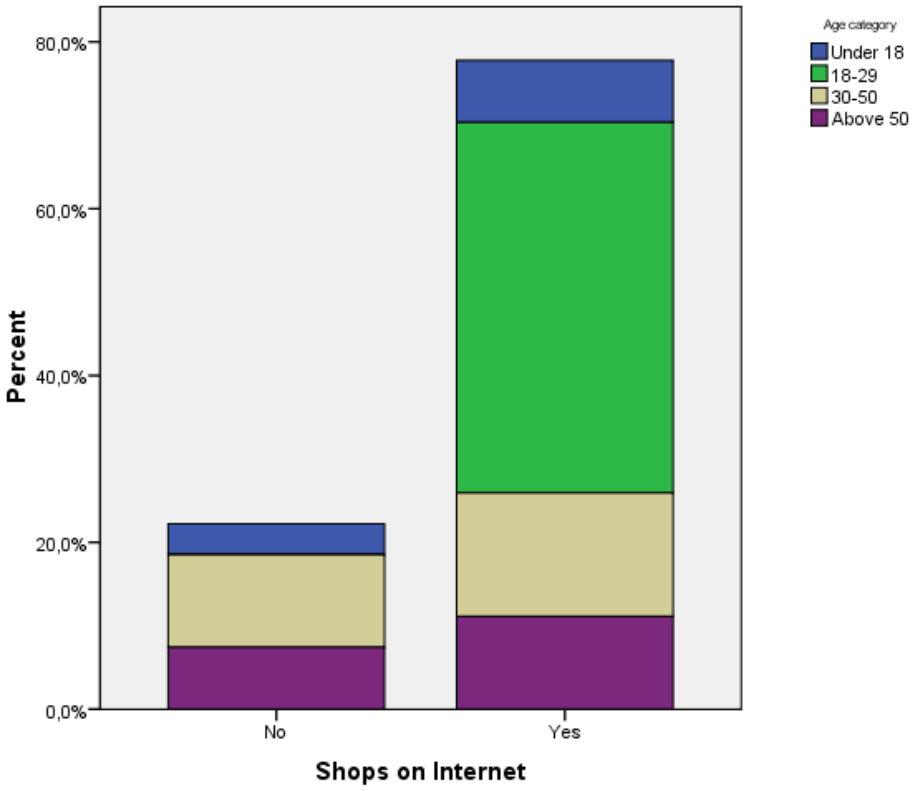

Figure 45. Percentage shopping online related to age

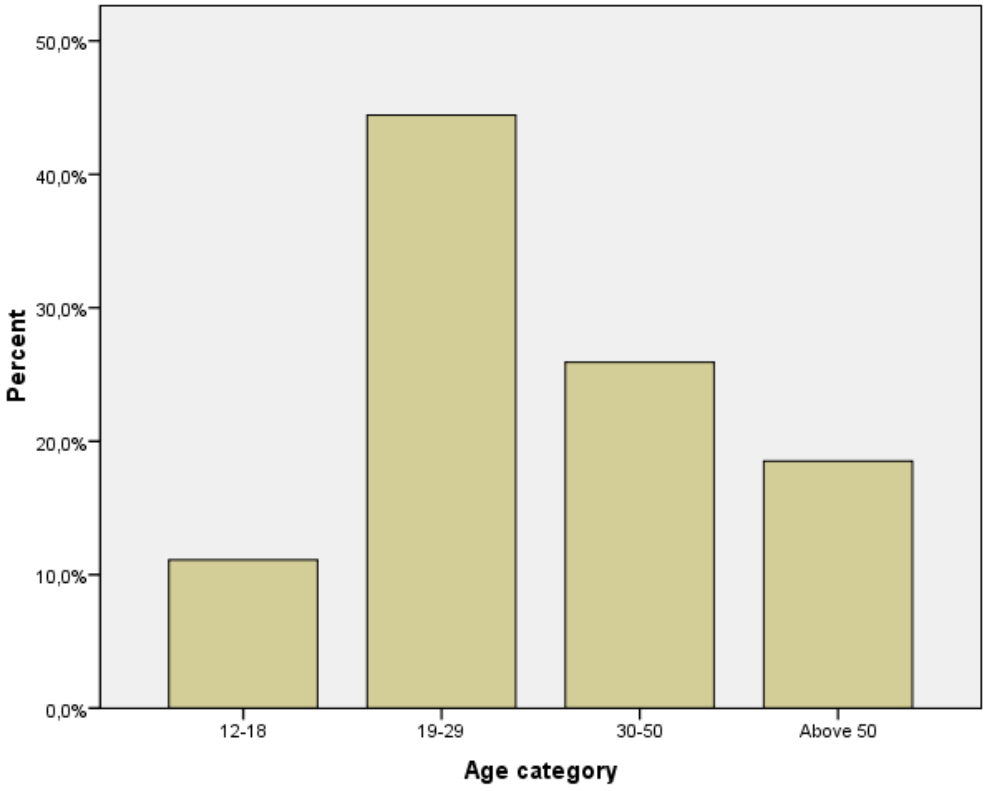

Figure 46. Age category partitioning

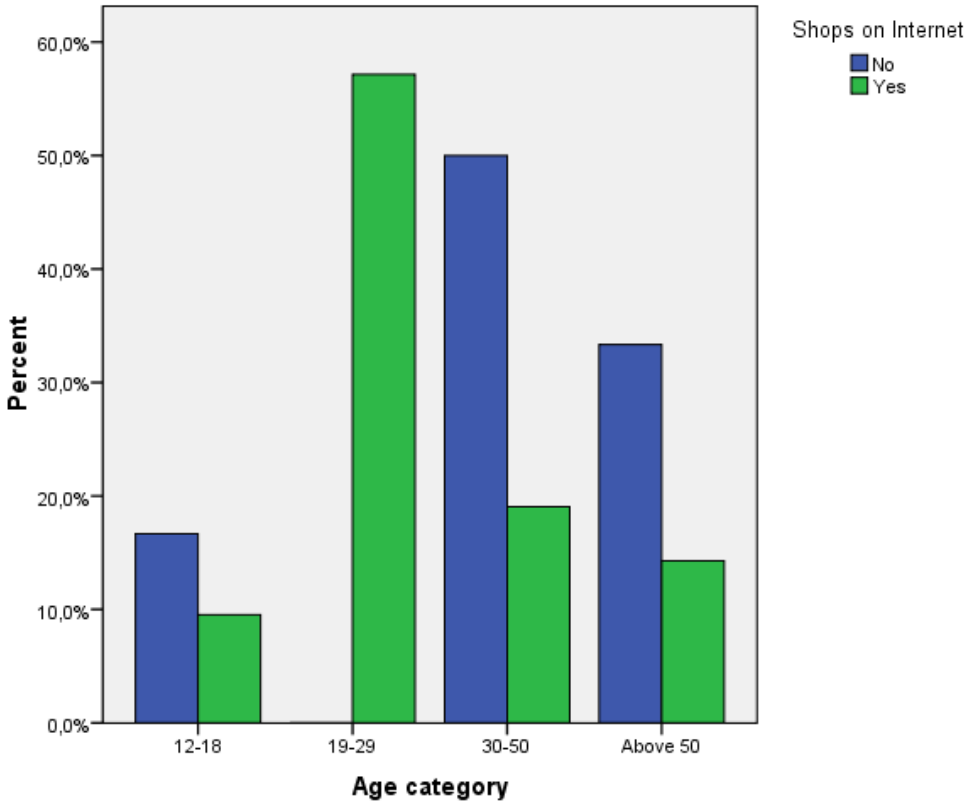

Figure 47. Relative percentage per age category that shops online

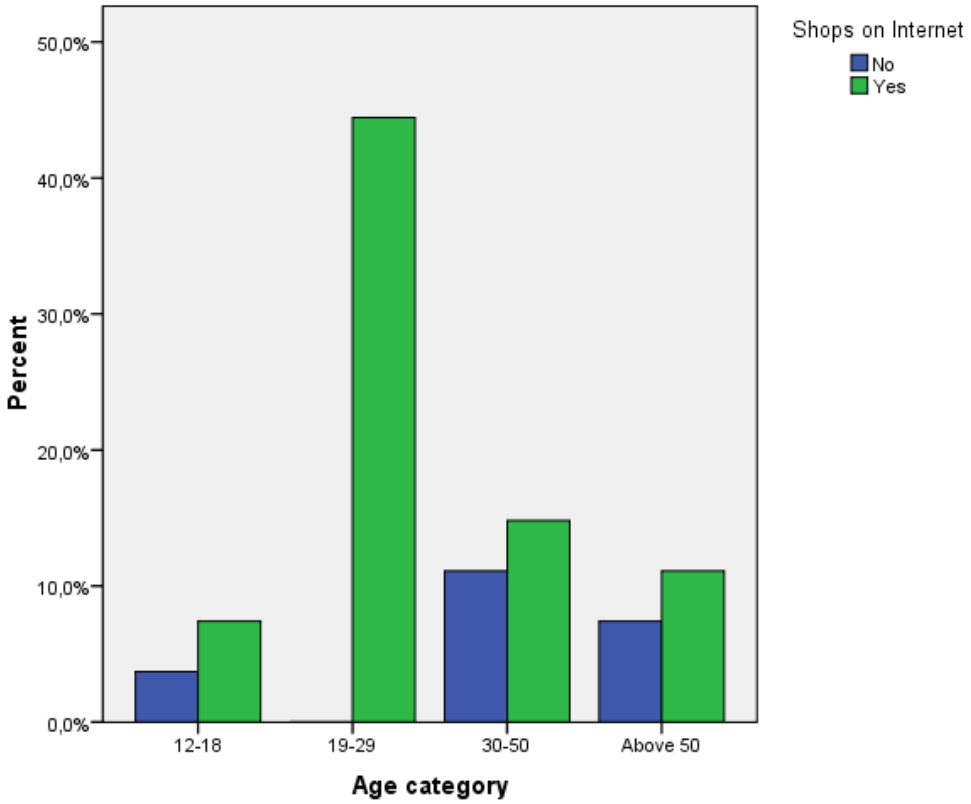

Figure 48. Total percentage per age category

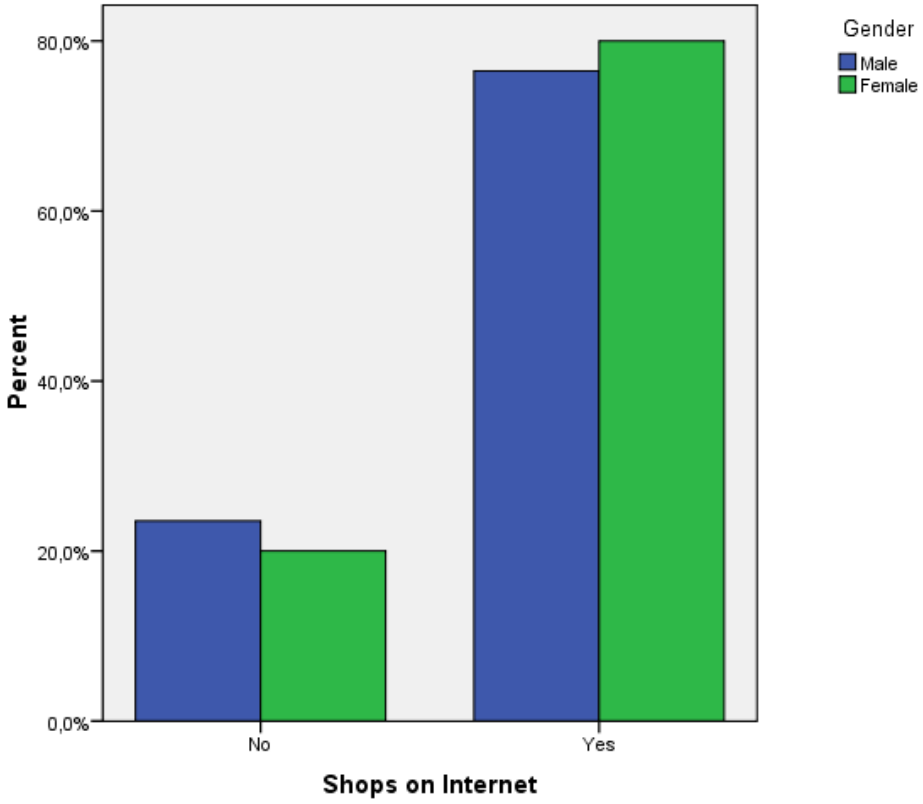

Figure 49. Shopping online related to gender

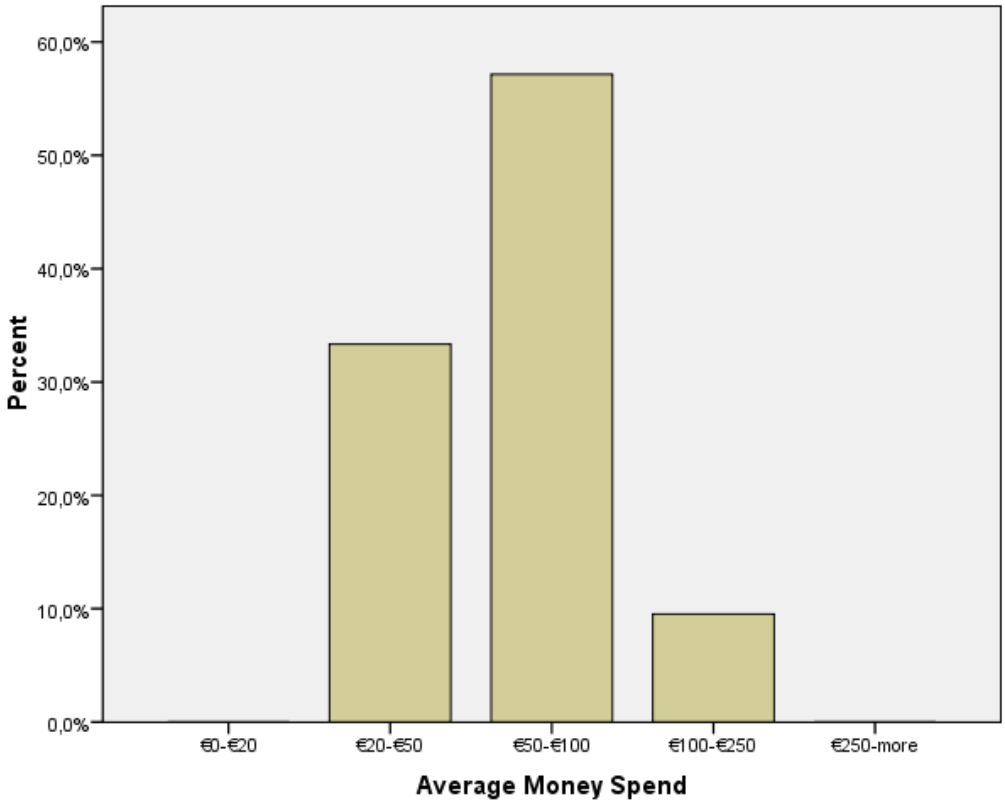

Figure 50. Average money spend

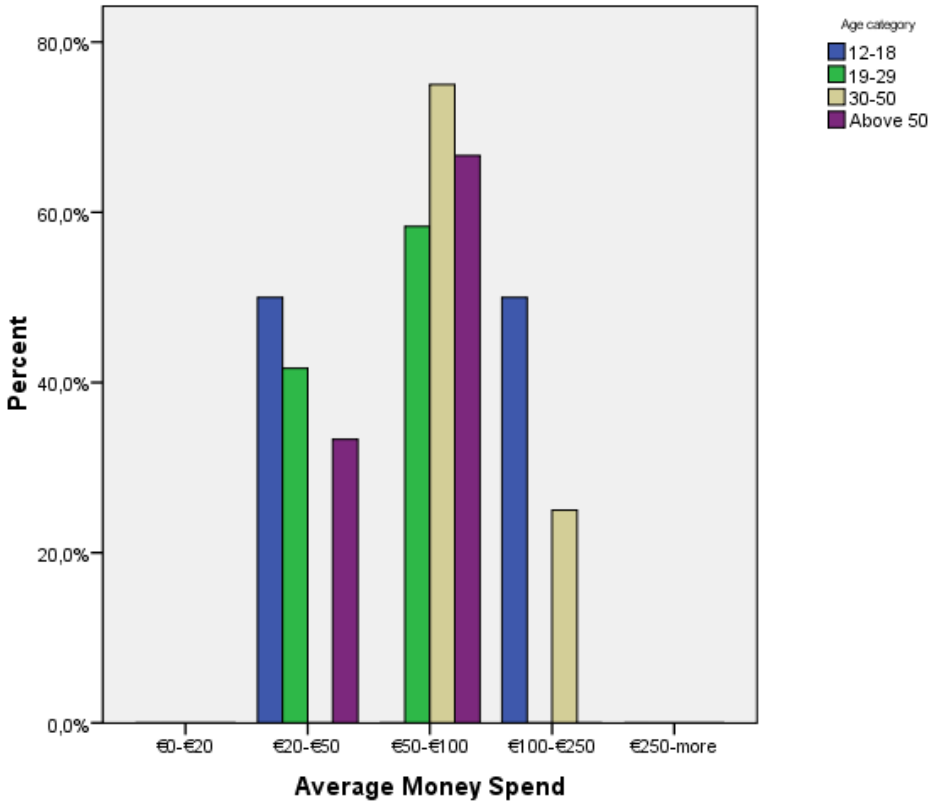

Figure 51. Average money spend related to age

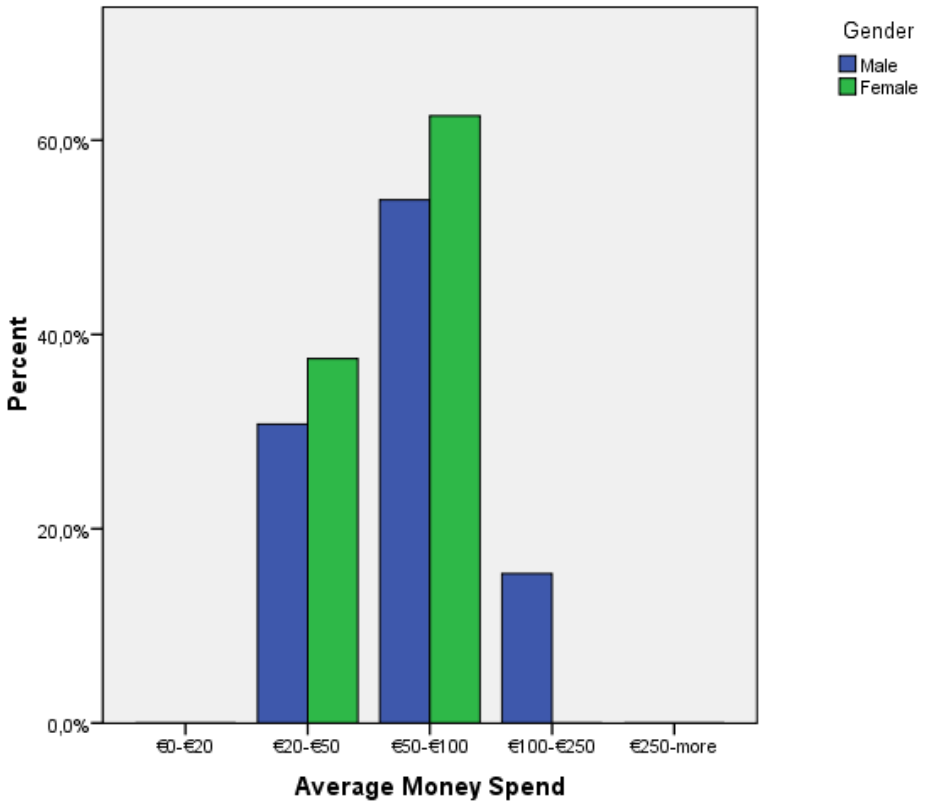

Figure 52. Average money spend per gender

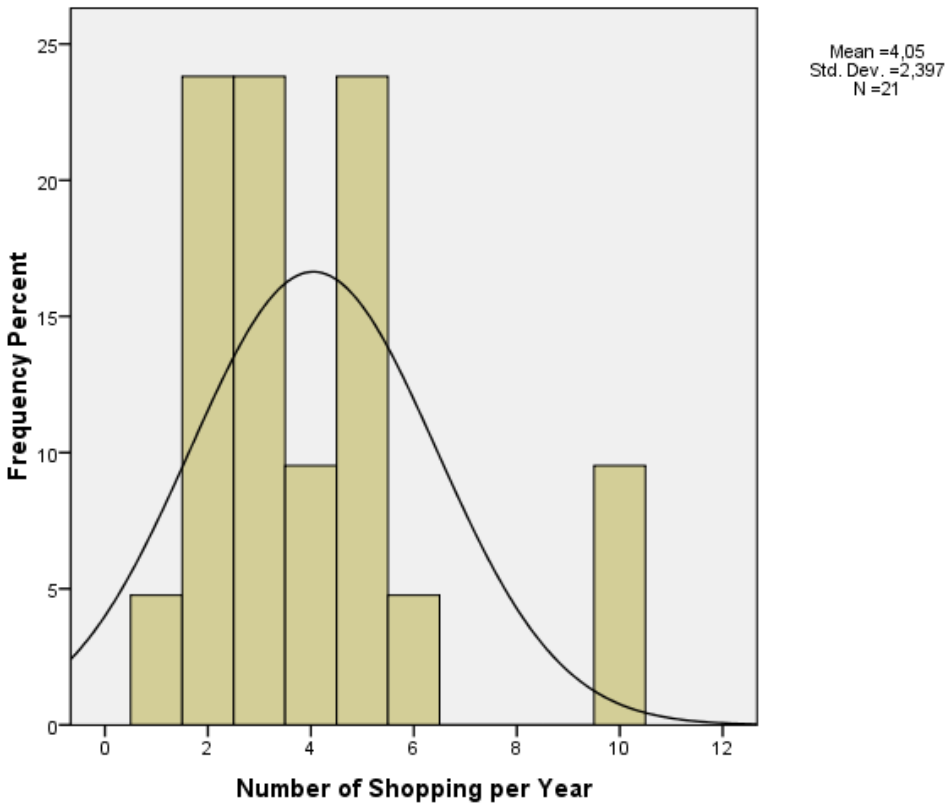

Figure 53. Histogram of number of shopping done per year with normal curve

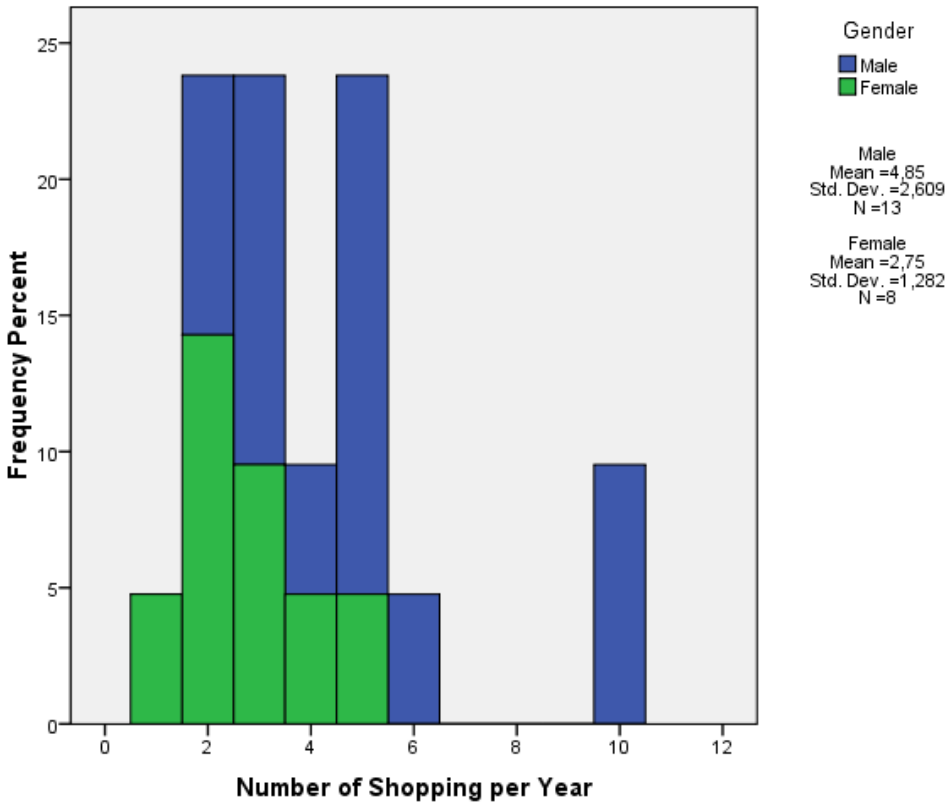

Figure 54. Histogram of shopping done per year per gender

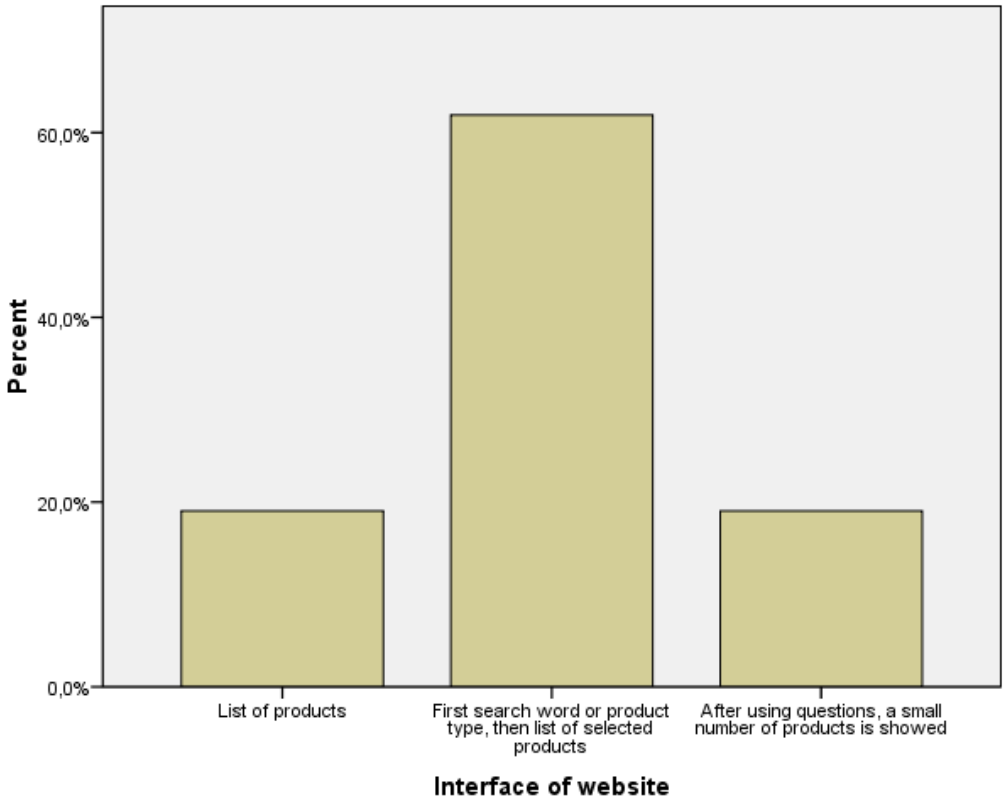

Figure 55. Interface used by respondent group

Appendix C

This appendix contains the graphs used in the proof of concept.

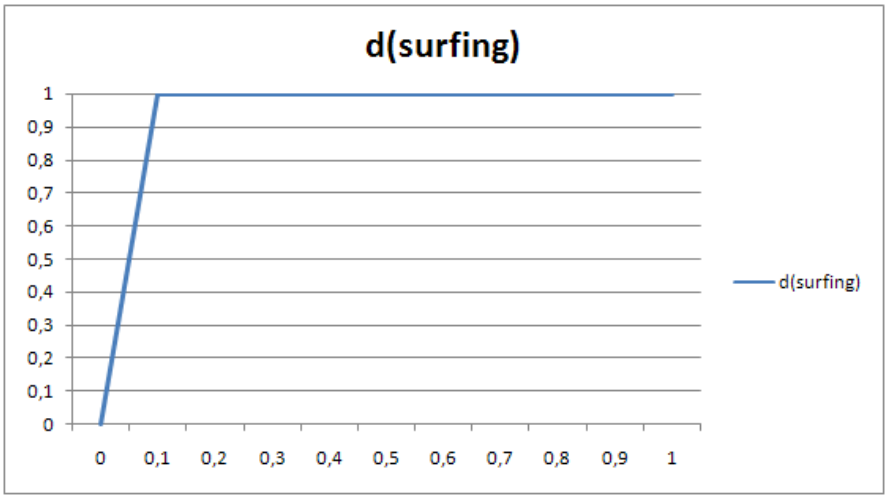

Figure 560. Interest graph for surfing

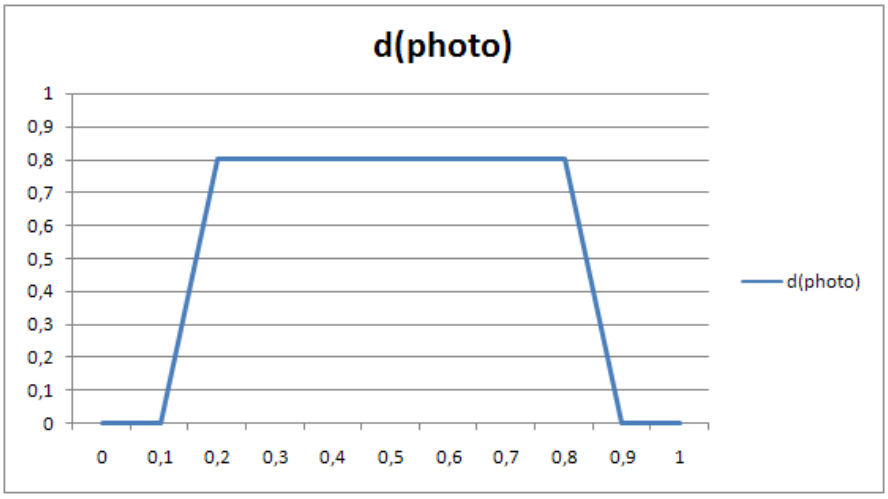

Figure 57. Interest graph for photo editing

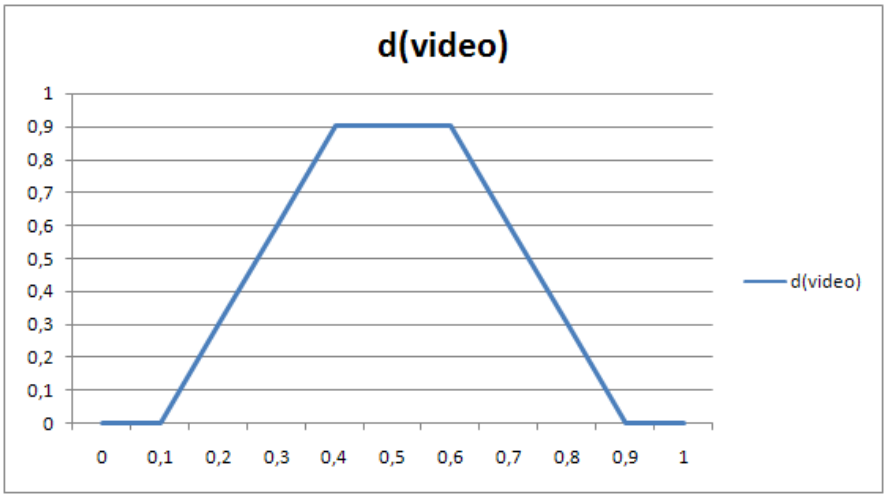

Figure 58. Interest graph for video editing

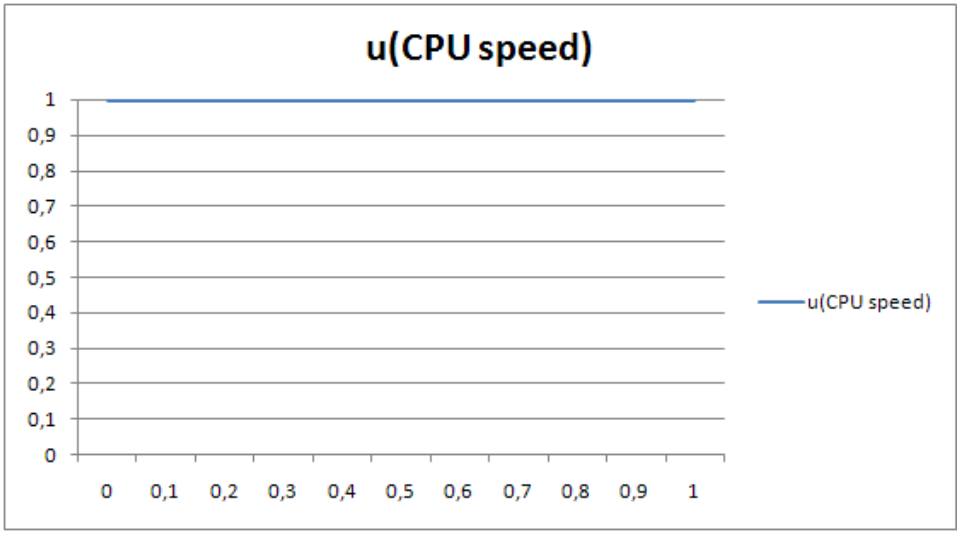

Figure 59. Usability CPU speed for surfing

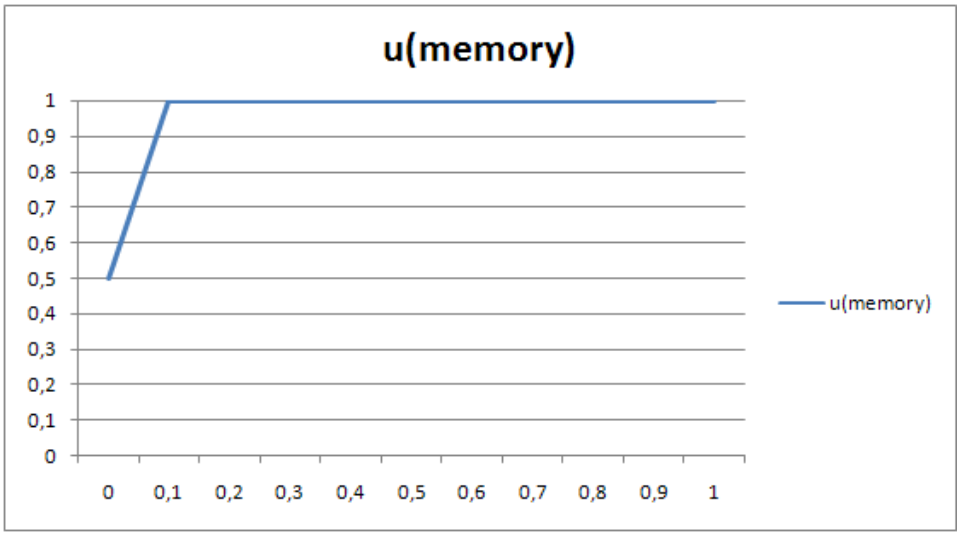

Figure 60. Usability memory size for surfing

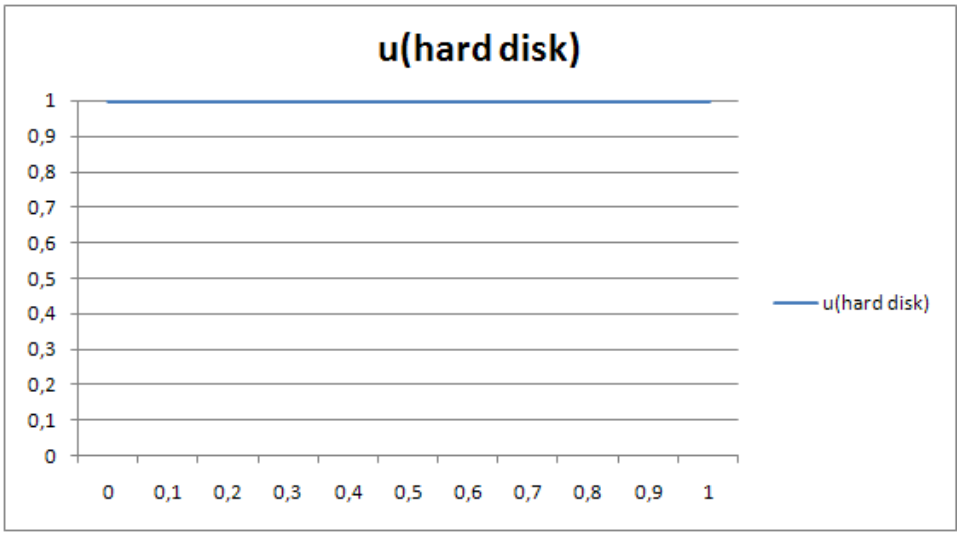

Figure 61. Usability hard disk size for surfing

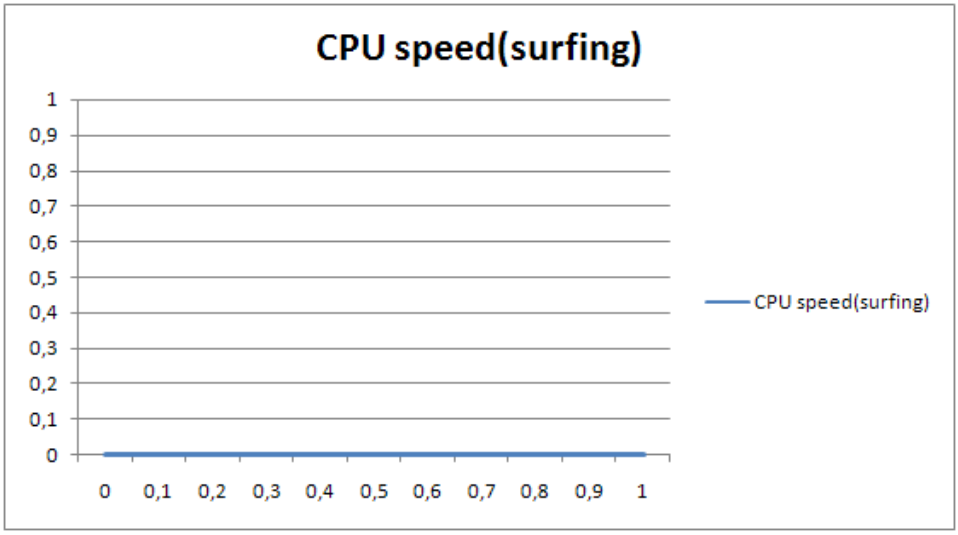

Figure 62. CPU speed related to surfing

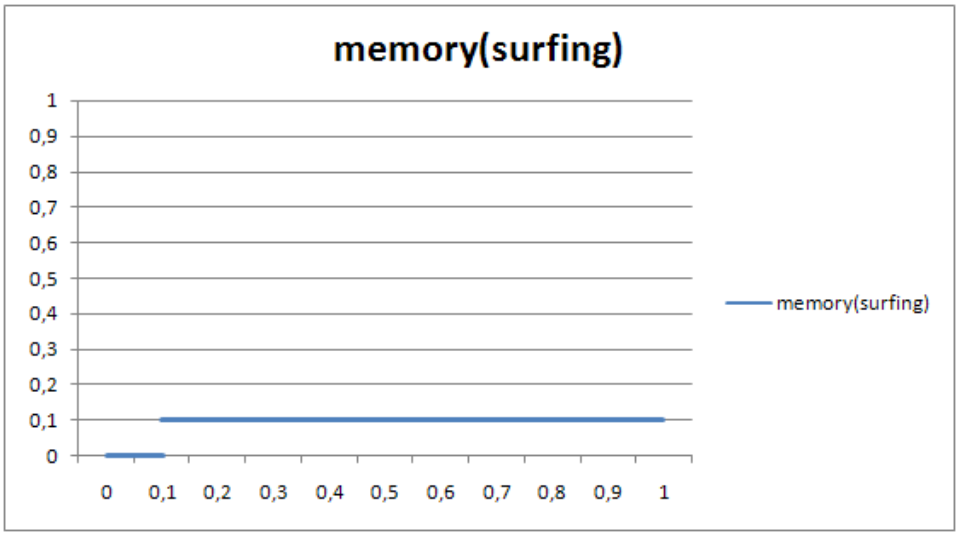

Figure 63. Memory size related to surfing

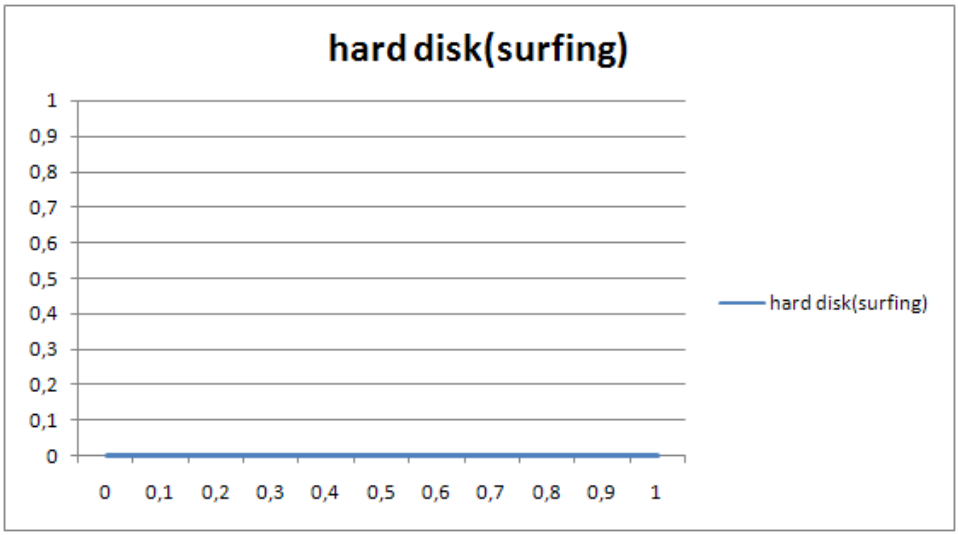

Figure 64. Hard disk size related to surfing

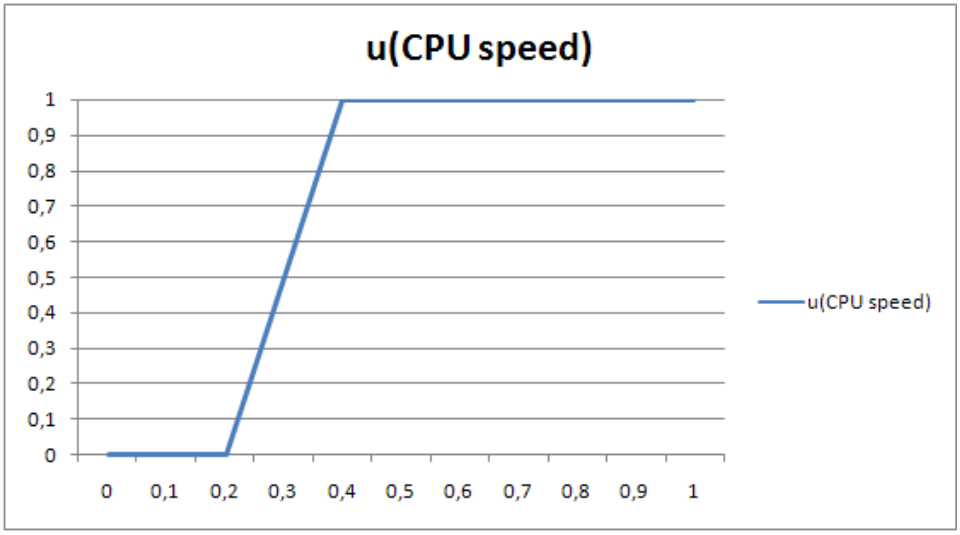

Figure 65. Usability CPU speed for photo editing

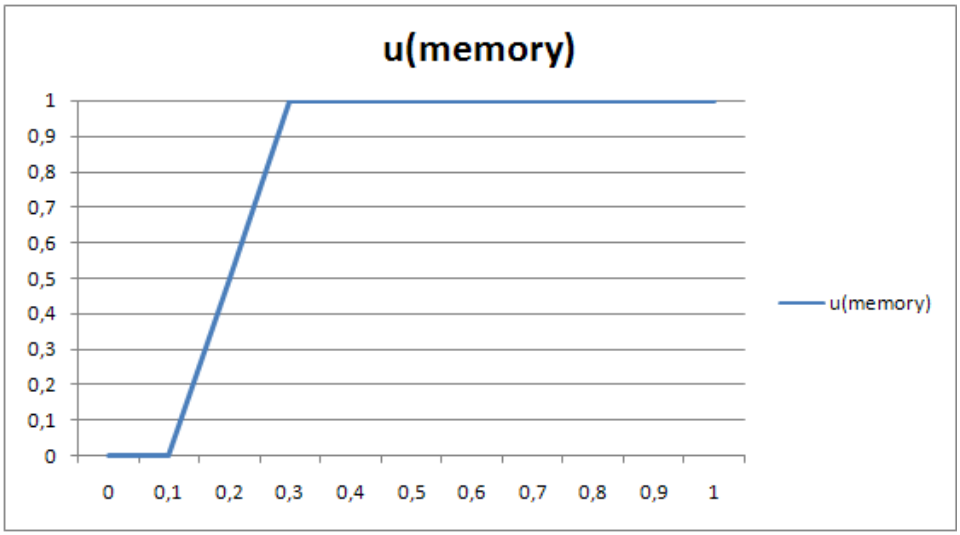

Figure 66. Usability memory size for photo editing

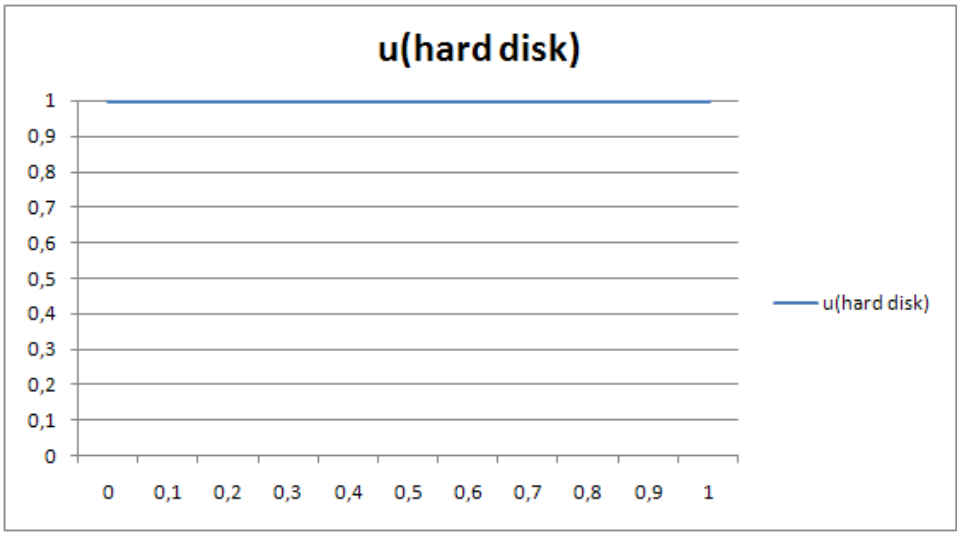

Figure 67. Usability hard disk size for photo editing

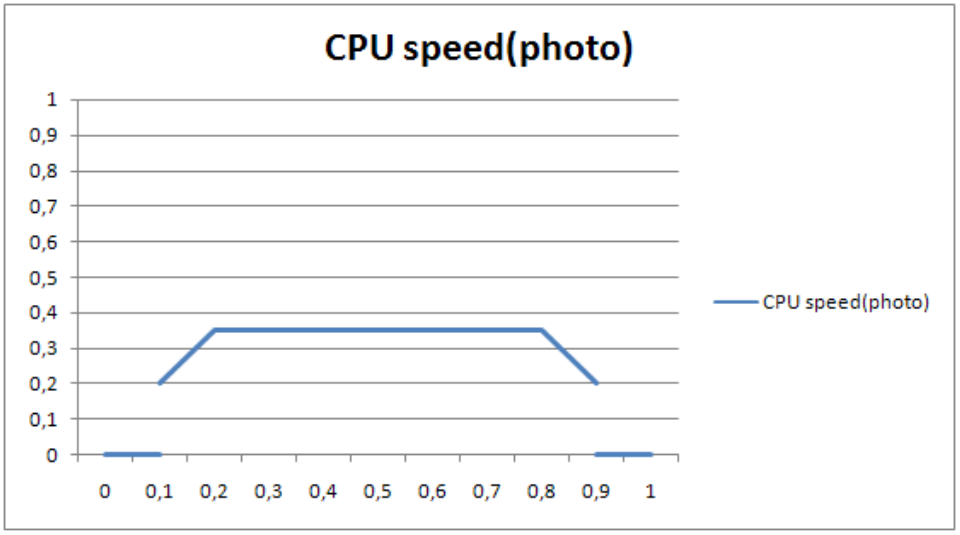

Figure 68. CPU speed related to photo editing

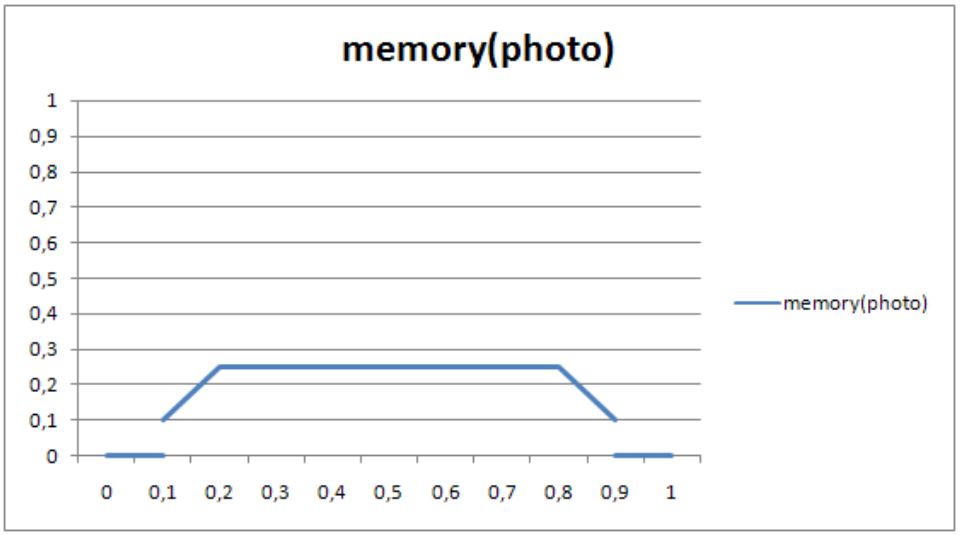

Figure 69. Memory size related to photo editing

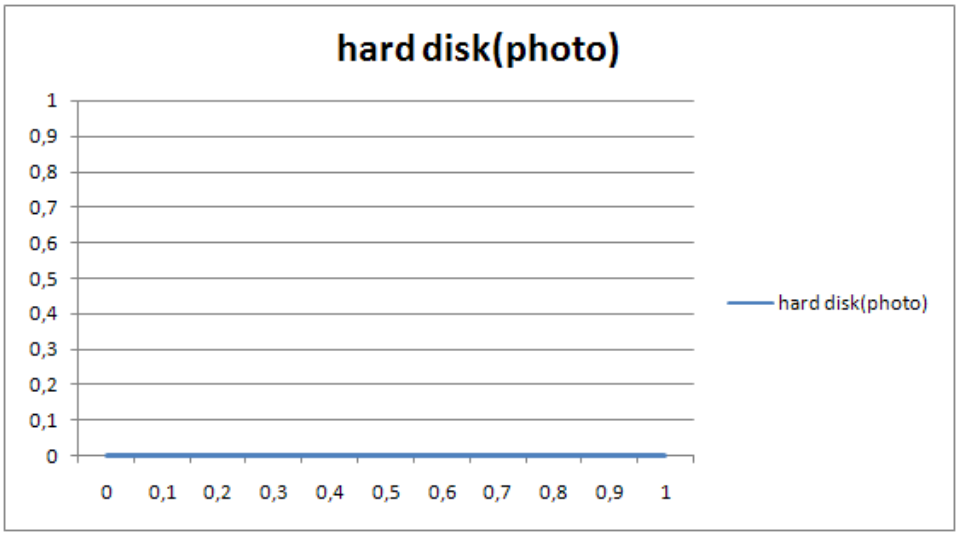

Figure 70. Hard disk size related to photo editing

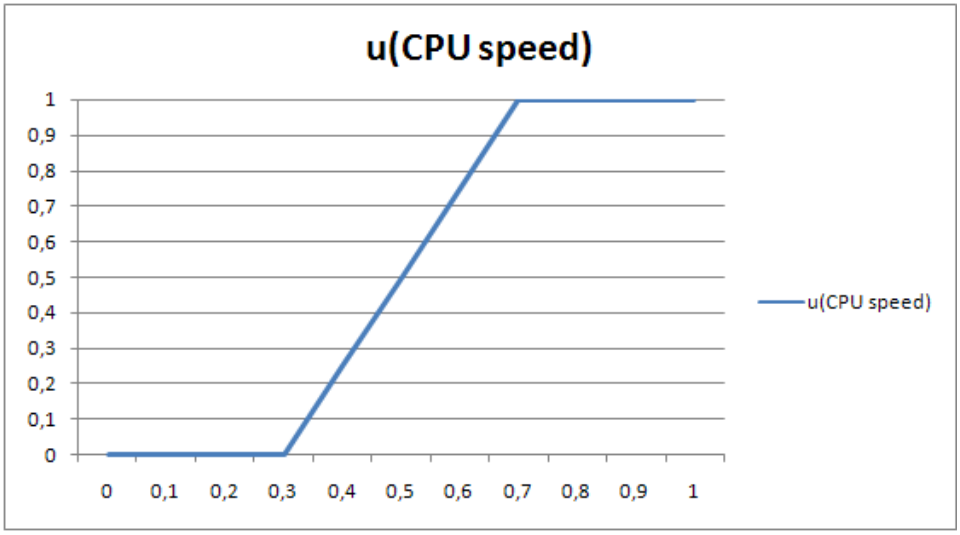

Figure 71. Usability CPU speed for video editing

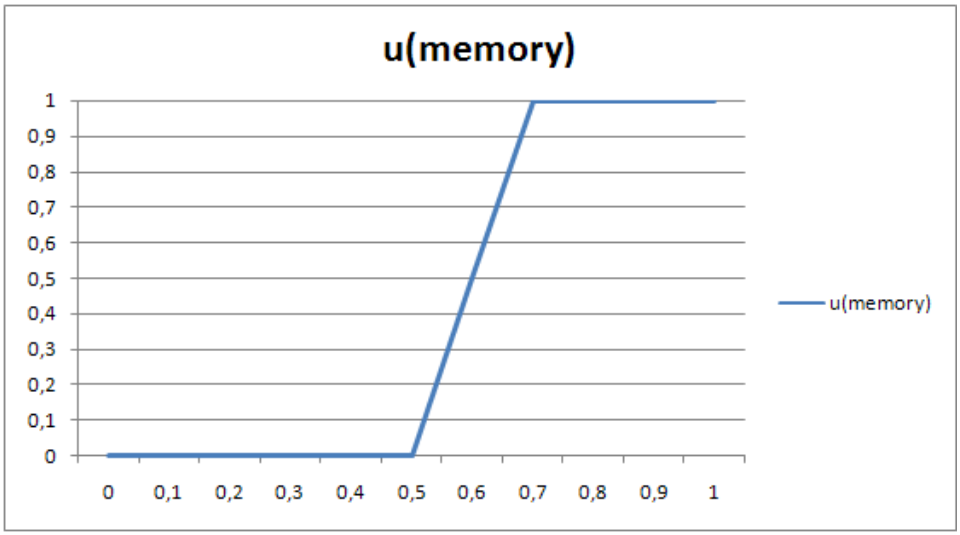

Figure 72. Usability memory size for video editing

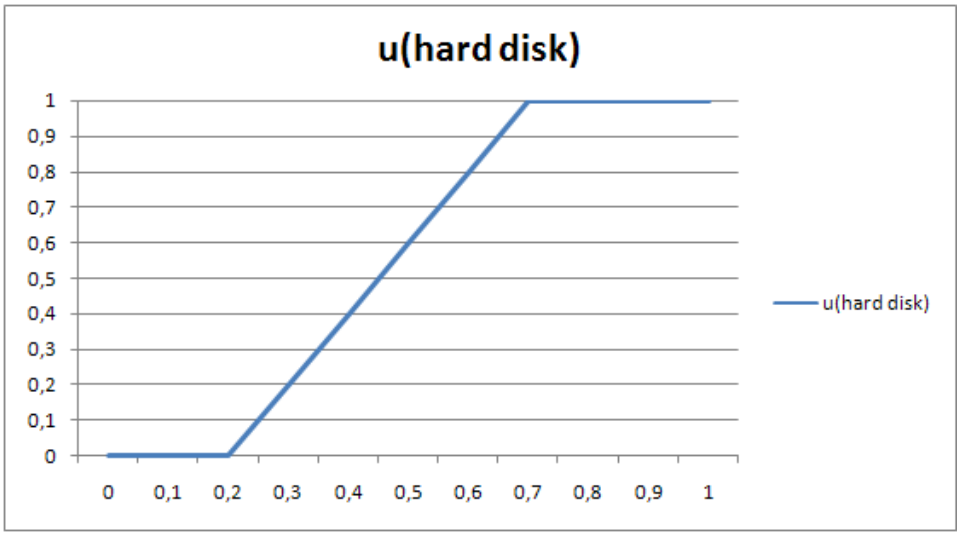

Figure 73. Usability hard disk size for video editing

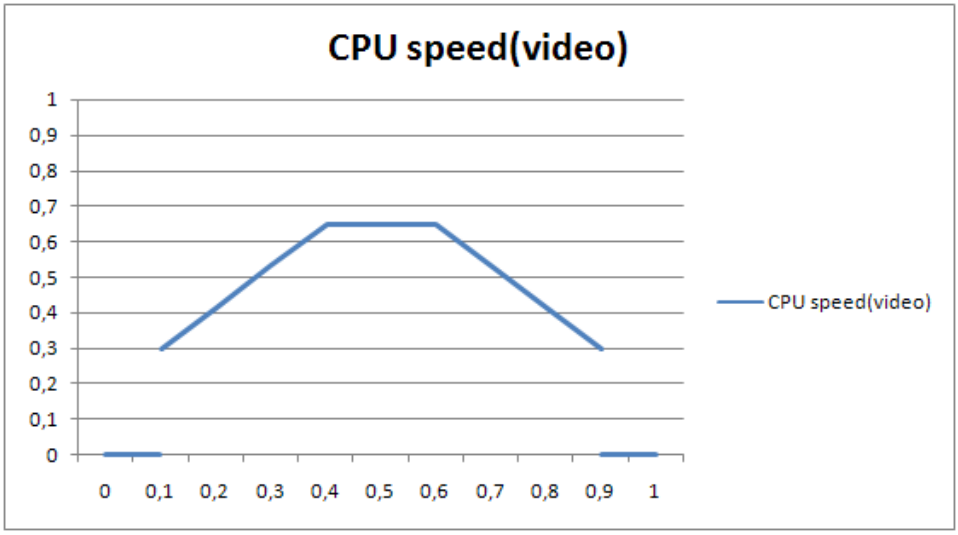

Figure 74. CPU speed related to video editing

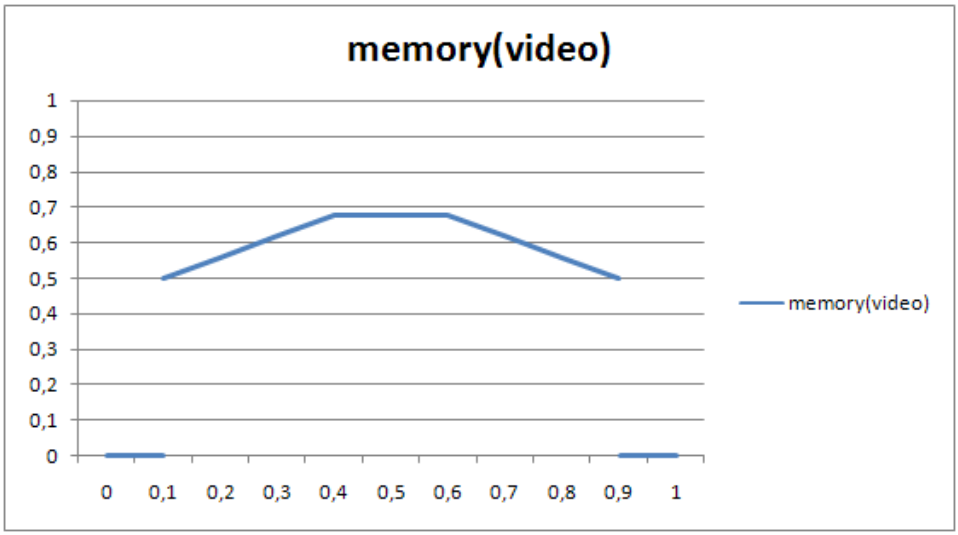

Figure 75. Memory size related to video editing

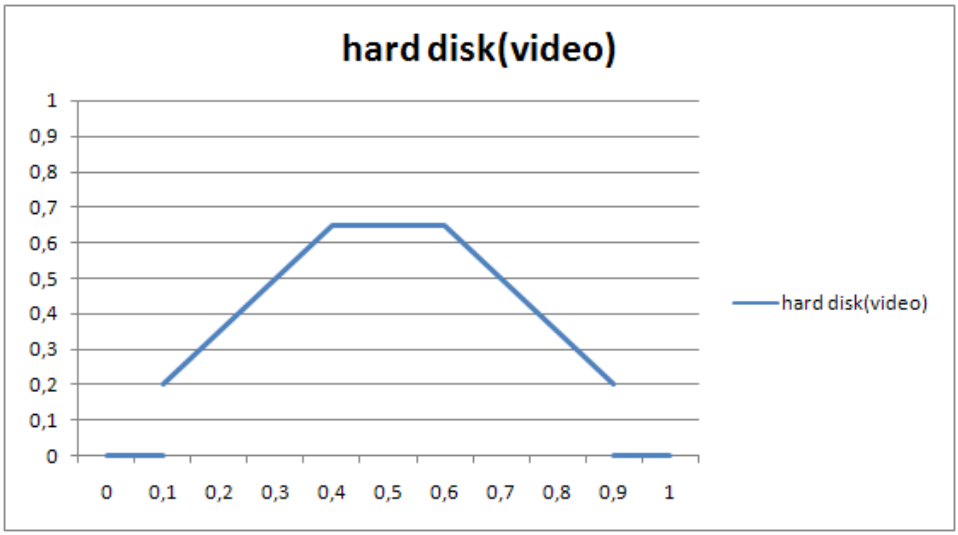

Figure 76. Hard disk size related to video editing