Meeting the Needs of the Web User

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Target Audience
The target audience of this paper is anyone interested in the design of web pages or software in general. The paper primarily deals with the user side of websites, from a fairly marketing oriented perspective, thus it will be of benefit to readers without a highly technical knowledge.

Purpose of this Article
This paper will attempt to deal with the paradox that arose from Jakob Nielsen's literature that seeks to provide a heuristic approach to designing websites with a heavy weighting on usability. The intention with this research in this paper is to prove that content and usability are equally important, as well as to describe and model the preferences that web users have given the characteristics: age, computer usage, internet connection speed and nationality

Executive Summary

This project addresses the paradox from Jakob Nielsen's book "Designing Web Usability: The Practice of Simplicity" where he introduces the "silver bullet" for making a successful website: the HOME RUN:

High-quality content, **O**ften updated, **M**inimal download time, **E**ase of use, **R**elevant to users needs, **U**nique to the online medium, **N**et-centric corporate culture

The paradox arises because the H, O and R are related more to content than usability, and the N is more or less a matter of creating an appealing web application that is in line with the corporate culture. However, Jakob Nielsen's book almost solemnly described the design related to usability.

This project will demonstrate that content and usability overall are perceived as equally important. The research in this project indicates that the language spoken in a web user's country is paramount for determining the preferences of the web user. This is surprising, since much focus on usability design has been on the research into the physical characteristics of the users when, as this project suggests, the major determinant of a web user's preferences is his or her native language. Another key finding of the research is that the difference in a preference for either usability or content is actually a tradeoff where the usability users are willing to trade the presence of ads and other interferences for the fact that a website should be in their native language whereas a content preferring user is more concerned with not receiving ads and the like and is willing to trade this for a website being in a language different from his or her native language.

Based on the findings of this project, a decision tree model based on a Bayesian approach will be developed, this model can be used to assist in the process of website design, in that it will be able to give insight into the probable user behavior and preferences based on a few facts about the user. Furthermore, the data mining methodology developed during this research can be used as an asset combined with conjoint analysis in other behavioral studies.

In conclusion, a suggestion for future research would be some more in-depth analysis of the language phenomenon, as it is most likely that we are only looking at the tip of the iceberg in web users' behavior. Behind the language phenomenon there could some interesting culturally related parameters waiting to be discovered by behavioral scientists.

Table of Contents

Executive Summary 2
Table of Contents 3
Figure and table reference 4
Acknowledgements 5
Introduction 6
  Problem statement 6
  Research objectives 7
  Background 8
Methodology 11
  Sampling design 11
  Research design 15
  Data collection 17
  Data Analysis: Conjoint Analysis 18
  Data Analysis: Modeling User Behavioral Segments 27
  Limitations 40
Findings 42
Conclusion 45
  Summary and conclusions 45
Recommendations 46
Appendixes 47
  Appendix 1 - The Web Survey 47
  Appendix 2 - Construction of model based data mining 50
  Appendix 3 - The User Preference Category Model 64
Bibliography 65
  Books 65
  Articles and Web content 65

Figure and table reference

Figure 1 - The force field of web applications 7
Figure 2 - Number of participants per month 17
Figure 3 - Average points assigned to the stimuli groups 18
Figure 4 - Average points assigned to the stimuli statements 18
Figure 5 - Mapping of participants for the revealed segments 21
Figure 6 - Average points per stimuli group for each of the revealed segments 21
Figure 7 - Average points per stimuli for each of the revealed segments 22
Figure 8 - The data mining process flow 28
Figure 9 - Age segmentation of the revealed segments 29
Figure 10 - Connection speed segmentation of the revealed segments 30
Figure 11 - Computer usage segmentation of the revealed segments 31
Figure 12 - Country segmentation of the revealed segments 32
Figure 13 - Regional segmentation of the revealed segments 34
Figure 14 - Language segmentation of the revealed segments 34
Figure 15 - The User Preference Category Model (UPCM) 43

Table 1 - Survey participants segmented by Age 12
Table 2 - Survey participants segmented by Connection Speed 12
Table 3 - Survey participants segmented by Computer Usage 13
Table 4 - Survey participants segmented by Country 13
Table 5 - Survey participants segmented by Region grouping of Countries 14
Table 6 - Survey participants segmented by Language grouping of Countries 14
Table 7 - Options for survey questions 15
Table 8 - Average constant sum distribution on stimuli for the revealed segments 23
Table 9 - Average ranking of stimuli for the revealed segments 24
Table 10 - “Age rule” reliability assessment 30
Table 11 - “Connection speed rule” reliability assessment 30
Table 12 - “Computer usage rule” reliability assessment 31
Table 13 - “Country rule” reliability assessment 33
Table 14 - “Region rule” reliability assessment 34
Table 15 - “Language rule” reliability assessment 35
Table 16 - “Weighted country rule” reliability assessment 35
Table 17 - Simple rule set based on data mining 36
Table 18 - Simple rule set with two amendments based on data mining 37
Table 19 - Full rule set based on data mining 37
Table 20 - Full rule set based findings of data mining with exceptions 39
Table A2.1 - Data mining findings on “Level 1” 50
Table A2.2 - Data mining findings on “Level 2” 52
Table A2.3 - Data mining findings on “Level 3” 59

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During the entire project, the coaching and inspiration by Patrick Robinson has been invaluable. Additionally, the delivery of research resource tools for analysis by TARGIT A/S, www.targit.com, has facilitated valuable analytical findings.

Introduction

Problem statement

The goal of this project is to highlight the force field between usability, content and appeal. In recent years, usability has been promoted as one of the keys to success on the internet and any other web application based on internet technology, however, with reference to Jakob Nielsen's HOME RUN (Nielsen, 2000: p380, p382), the "silver bullet" for the web allegedly lies in providing a website that meets the following criteria:

High-quality content
Often updated
Minimal download time
Ease of use

Relevant to users' needs
Unique to the online medium
Net-centric corporate culture

However, the HOME RUN methodology essentially holds what in the following will be referred to as Jakob Nielsen's Paradox: since the H, O and R are related more to content than usability, and the N is more or less a matter of creating an appealing web application that is in line with the corporate culture. Nielsen's book "Designing Web Usability: The Practice of Simplicity" almost solemnly describes the art of developing usability, so where does this leave those who attempt to develop state of the art web based applications?

How important is usability compared to content and appeal?

If one attempts to answer these questions by a simple count of letters in Nielsen's HOME RUN, the hypothesis of this project comes to life:

Content and Usability are equally important when designing web applications

Testing this hypothesis without rejection would add to the existing theory of designing web page usability in that it simplifies the priorities in the HOME RUN mantra which is the product of the leading literature on the subject[1].

In addition to testing the hypothesis, this project will seek to combine the findings of the research into a User Preference Category Model, which is a decision tree model

[1] A hypothesis should be: adequate for its purpose, testable, have greater range, explain more facts and a greater variety of facts while being simple and requiring few conditions and assumptions (Cooper & Schindler, 2001: p. 50, 51).

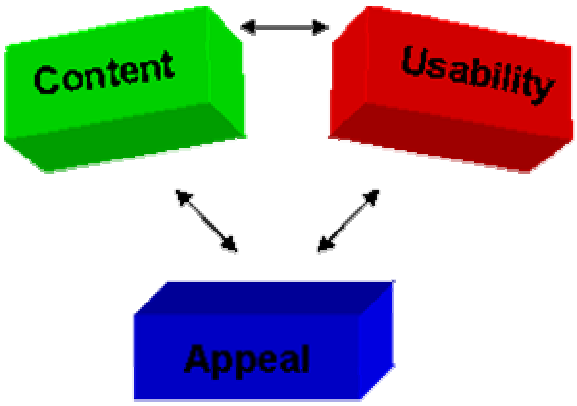
based on a Bayesian approach. This model can be used to assist in the process of website design, in that it will be able to give insight into the probable user behavior and preferences based on a few facts about the user.

Research objectives

The overall objective of this project is obviously to test the hypothesis that content is at least as important as usability right. However, it is also desirable to be able to create a model based on the analytical findings that will allow designers to "get lucky" from knowledge about their users' characteristics.

By researching the force field between the three factors that together make up a website from the users' perspective, the individual strengths of these forces can be assessed with regards to the users' characteristics. The force field is shown in figure 1. This research project deals with the users' perspective, thus does not take into account that the experience of some users of different types of web applications might require extensive hardware and software investments. Also, since the research attempts to provide a generic model for all web development, it does not take into account the different situations in which a user accesses a web application; the research sees the internet as one holistic web application that all the users access as one.

Figure 1 - The force field of web applications



Any application is a tradeoff between these factors, which interfere with each other. This project is based on the following definitions of usability, content and appeal:

Usability is the discipline of providing a web application that is easy and logical to navigate, fast loading and with a layout and language that is easily read by the user.

Content covers the range from the reliability and focus of the content to the possibility of communication with the content providers. In this category is also the inter-linkage of the content of the web application with other applications e.g. search engines.

Appeal is basically the way the content and usability are wrapped in terms of a design that leaves a good first impression as well as the use of explanatory graphics, animation and sound. This category also covers the softer issues of the feelings we get e.g. if the user feels safe from virus and other security violations when operating the web application.

Background

The theory of web design as formulated by Jakob Nielsen in his book “Designing Web Usability: The Practice of Simplicity” has inspired this research project. In his research he has searched for a heuristic approach to web design, and the findings are presented in the book as useful guidelines for design of web applications with a heavy weighting of usability as also indicated by the title. Jakob Nielsen’s HOME RUN (Nielsen, 2000: p380, p382) is part of the conclusion of the book and, as stated in an earlier article: “Jakob Nielsen – The Guru of Web Page Usability” by this author, the book lacks an assessment of the balance between content and usability, even though the book highlights content as the primary driver of a HOME RUN –at least in terms of letters. The article voices the question of whether Jakob Nielsen intentionally allowed content to account for a 60/40 balance against usability.

The book does not answer these prioritizing questions, and this is a weakness since designers of websites will not be able to focus their efforts and prioritize resources when building new websites that are desired to meet a “HOME RUN”. And as Jakob Nielsen is not only an agitator for heuristic web application design, but also for usability testing, the question of the optimum number of people who should be testing content arises.

Inspired by this built in paradox from one the most acknowledged authors on the subject of usability the quest for uncovering at least a few more “square feet” on the subject has arisen.

Turning now to the process of doing this, one needs to determine the optimal analytical method for assessing user preferences. For this purpose, significant inspiration has been found in the field of marketing research in which the determination of users’ preferences has been the primary focus of the science of *conjoint analysis*.

Conjoint analysis is used to measure complex decision making that requires multi-attribute judgments (Cooper & Schindler, 2001: p. 246). This rather new type of analysis for behavioral research gives more in depth knowledge of the tradeoffs that

a user makes during decision making. Whether the decision is a matter of buying or using for free, the user makes tradeoffs in any given scenario. Conjoint analysis will not only reveal the preferences but also the tradeoffs and, by identifying the features, in this field termed *stimuli*, it is possible to not only use the conjoint analytical findings to identify today's preferences, but it is also possibly to model this knowledge, thus use the findings in future designs and products.

According to Paul Green, author of "Researching for Marketing Decisions", conjoint analysis is concerned with the measurements of psychological judgments such as consumer preference. However the major distinction between conjoint analysis and other methods such as multi-dimensional scaling is that conjoint analysis is based on predefined behavioral stimuli that are defined before the sample data are gathered, whereas other approaches attempt to identify the behavioral parameters post hoc. During the sampling of data, each stimulus is then associated with a utility according to how desirable the user assessed it as being (Green, Tull & Albaum, 1988: p. 616).

In this project, the constant sum distribution is particularly interesting since its simplicity eases the instruction of participants in the survey (Green, Tull & Albaum, 1988: p. 291). This is ideal since this project is to be conducted using research data gathered via a web application. The rationale for this decision is that the users who have an opinion about web applications are most likely similar to those who are reachable via the web; furthermore the potential for gathering a multi-national sample is appealing in this approach.

As a supplement to the constant sum conjoint approach, a ranking method is also used. According to Patrick Robinson, President of Robinson Consulting Inc, this combination can possibly produce more insight into the left brain thinking of the respondents; a tight analogy between the strict ranking and the more intuitive constant sum distribution could indicate a strict focus of the mind and a more loose analogy could indicate a weighting on either the left or the right part of the brain. The ranking approach also shares the characteristic of ease of instruction which is suitable for web surveys.

Another tool that will be used in this project is Bayesian decision theory. This type of approach has emerged from poker gambling and after more than two hundred it has years ended up as a useful tool for decision making. In essence, Bayesian decision theory formalizes the fact that a decision maker is usually faced with situations that have similarities with other events the decision maker has been exposed to or that have happened in general. This is done by assigning numerical weights, in this field called prior probabilities, to the incidents. These prior probabilities are then used, much like betting odds, for making a decision that is in line with the most probable outcome (Green, Tull & Albaum, 1988: p. 65). The decision tree arrangements of these incidents along with their prior probabilities will help to take into account that some incidents are more likely or more unlikely should another incident have preceded them.

By combining the conjoint analysis with the Bayesian decision tree, the flow of analysis in this project will go through the following steps:

1. Conjoint analysis is analyzed using bar charts and tables to identify the stimuli utility for all users in general.

2. A number of revealed segments are identified. The aim to identify segments that behave differently within the force field of figure 1, in other words segments with different preferences for content, usability and appeal. Specifically we will work with three segments: the users that rated content higher than usability, the users that rated usability higher than content and finally the users that rated content and usability equally important. The revealed segments are analyzed to identify their similarities and dissimilarities in terms of stimuli preferences.

3. Having described the revealed segments in terms of their behavioral preferences as described above, a Bayesian approach is used to build a decision tree based on the characteristics of the users that fell in either the content or the usability preferring segment. This model can then be used by usability engineers and decision makers to determine the most likely revealed segment that is likely to frequent a website based on the users "physical" characteristics. Using the decision tree model, it is possible to identify the most likely revealed segment with an accuracy that increases with the depth of the decision tree. However, it should be noted, that the potential for statistical error also increases with the depth, since the sample data behind the rules are decreasing with the depth of the tree.

…

Inspired by Jakob Nielsen’s paradox and armed with the tool of conjoint analysis and Bayesian decision theory, this project was launched.

Methodology

Sampling design

The intention of the research of this project is to learn about web users preferences. According to Jakob Nielsen, there were about 200 million web users in 2000 (Nielsen, 2000: p. 348), a figure that is expected to reach 500 million in 2005, so census is not an option, not because of the Deming argument of greater accuracy in sampling since the interviews are done by the participants themselves via the Internet, but because of the speed with which this survey would reach the participants (Cooper & Schindler, 2001: p. 163, p. 164). It took almost 4 months to reach 300 participants.

I intended to gather a random sample but I started simply by sending out questionnaires to everyone in my own contact library, then allowing these people to resubmit the questionnaire to others after completing the survey themselves. This approach allowed the survey to move as "ripples in the water", but it had the potential for loss of accuracy as the survey would not reach segments that were far away from the initiators "world", and would therefore reach only individuals with a certain bias. However, this approach seems justified overall, since practically everyone who accessed the internet was a potential respondent to the survey.

With reference to Jakob Nielsen's arguments for usability; that pages should be fast loading (Nielsen, 2000: p. 46) based on the availability of connection speed (Nielsen, 2000: p. 49) and easily read by the global audience (Nielsen, 2000: p. 315) as well as users with disabilities such as those which are age-related (Nielsen, 2000: p. 298) has lead to the gathering of the sample parameters: age (table 1), connection speed (table 2) and nationality (table 4). The parameter of how often a computer is used (table 3) was added, the rationale being that ease of use might be perceived differently by experienced users and novices. Based on nationality, the following sample statistics were calculated: geographical region (table 5) and whether the country was English speaking (table 6). A detailed documentation of the survey can be found in Appendix 1.

Much folklore is associated with sampling, and the two most common myths are that 1. a sample needs to be large or it is not representative, and 2. a sample should bear some proportional relationship to the size of the population from which it is drawn. However, in reality the appropriate size of a sample is a function of the variation in the population parameters under study and the accuracy and the precision needed (Cooper & Schindler, 2001: p. 163, p. 172). This is confirmed by Robinson Consulting Inc. in Research Update #85: "Population Sampling Issues and Reminders" published on their website, which also states that the necessary sample size varies depending on whether one is dealing with a 50/50 or 90/10 population. As an example of this, one needs only a sample of 120 to achieve a 99% confidence

level with a ±7% precision in a 90/10 population whereas the corresponding sample size is 340 in a 50/50 population.

The rationale of Robinson Consulting to some extent justifies the tradeoff in the decision tree approach as we will find in the data analysis. As noted before, the rules in the decision tree become more accurate with the depth of the tree, while the sample behind the rule decreases. However since a smaller sample is needed if a rule is more accurate, in this case with a higher Bayesian prior probability, then this rationale justifies a fairly deep decision tree approach.

The idea of assuming that sample accuracy does not necessarily improve with size is also confirmed by Jakob Nielsen himself; during a Usability conference in Copenhagen on 16th May 2002, he stated that an optimal sample size for many usability tests could be as few as 4 participants, moreover sometimes a decision about user behavior could be made with a sample of 1. Even though this is probably far from a given in all instances, this research project will argue that one should not neglect a behavioral finding even if it is based on a small sample.

Having described the sample size, now let us go through the segmentation of the sample population based on the information collected about the participants.

Table 1 - Survey participants segmented by Age

Age	Participants	Percentage
16-25	39	13%
26-35	211	70%
46-55	43	14%
56-65	1	2%
Total	300	100%

Table 2 - Survey participants segmented by Connection Speed

Connection	Participants	Percentage
High speed	237	79%
Medium speed	38	13%
Low speed	25	8%
Total	300	100%

Table 3 - Survey participants segmented by Computer Usage

Usage	Participants	Percentage
Every day	284	95%
4-6 days a week	14	5%
1-3 days a week	2	1%
Total	300	100%

Table 4 - Survey participants segmented by Country

Region	Participants	Percentage
Australia	4	1,3%
Bolivia	1	0,3%
Canada	8	2,7%
Chile	1	0,3%
Denmark	203	67,7%
Dominican Republic	1	0,3%
Finland	1	0,3%
Germany	2	0,7%
Hungary	2	0,7%
India	1	0,3%
Israel	1	0,3%
Japan	3	1,0%
Luxembourg	1	0,3%
Netherlands	1	0,3%
New Zealand	1	0,3%
Norway	1	0,3%
Pakistan	1	0,3%
Philippines	1	0,3%
Poland	2	0,7%
Romania	1	0,3%
Sweden	2	0,7%
Trinidad and Tobago	1	0,3%
United Kingdom	7	2,3%
United States of America	51	17,0%
Vietnam	1	0,3%
Zimbabwe	1	0,3%
Total	300	100,0%

Table 5 - Survey participants segmented by Region grouping of Countries

Region	Participants	Percentage
Europe [2]	223	74%
North America [3]	59	20%
Other [4]	18	6%
Total	300	100%

Table 6 - Survey participants segmented by Language grouping of Countries

Region	Participants	Percentage
English Speaking [5]	71	24%
Non-English Speaking [6]	229	76%
Total	300	100%

For more generic analysis, the groupings in tables 5 and 6 are introduced. We note that the distributions in both groupings are highly concentrated around participants from Denmark and the United States, who represent a high percentage in the region and language groups. However, as we will find in the data analysis, the validity of these groups will be justified.

[2] Denmark, Finland, Germany, Hungary, Luxembourg, Netherlands, Norway, Poland, Romania, Sweden, United Kingdom
[3] Canada, United States of America
[4] Australia, Bolivia, Chile, Dominican Republic, India, Israel, Japan, New Zealand, Pakistan, Philippines, Trinidad and Tobago, Vietnam, Zimbabwe
[5] Australia, Canada, New Zealand, United Kingdom, United States of America
[6] Bolivia, Chile, Denmark, Dominican Republic, Finland, Germany, Hungary, India, Israel, Japan, Luxembourg, Netherlands, Norway, Pakistan, Philippines, Poland, Romania, Sweden, Trinidad and Tobago, Vietnam, Zimbabwe

Research design

With reference to the description of the sample method, the collection of data was carried out via the Internet. The users were selected using a simple random selection by sending out emails and allowing others to refer people to the survey.

Each participant was asked about age, computer usage, internet connection speed and nationality. For the first three questions, the participant had the following options:

Table 7 - Options for survey questions

Question	**Options**
Age	<16, 16-25, 26-35, 36-45, 46-55, 56-65, >65
Computer Usage	Every day, 4-6 days a week, 1-3 days a week, Once a month, Less than once a month
Connection Speed	Low speed (e.g. modem, PDA/mobile), Medium speed (e.g. ISDN), High speed (e.g. cable/DSL)

Having answered the questions for the population parameters, the participant was instructed to first rank the following 12 stimuli statements according to his or her perception of importance for a good website, in other words a ranking of the stimuli statements in accordance with their utility. After the ranking, the participant was asked to assign a total of 100 utility points across the same 12 stimuli statements in accordance with their importance from the participant's point of view.

The 12 stimuli statements appeared to the participants in the following order:

- *The pages are easy and logical to navigate and fast loading*
- *The pages use effects such as animation and sound*
- *The website allows me to interact with other users or content providers*
- *There is a sitemap and a search function that allows free text searches*
- *The website has a streamlined design that leaves a good first impression*
- *The content is reliable and is frequently updated*
- *The page layouts have column width and fonts that are easily read*
- *The website uses graphics to improve the understanding for the user*
- *It is possible to locate the website through a search engine*
- *The pages are in my native language*
- *I feel safe from virus and other security violations*
- *The website has focused content and there is not a lot of other content such as ads*

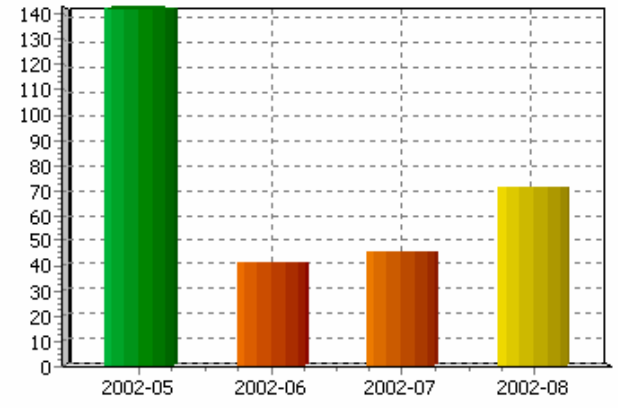
The difference from the ranking to the constant sum was that in the latter, multiple statements could be rated as having equal importance and some could be rated as having no importance at all. The mindset behind this difference is that in the ranking,

the user will be more focused on the mathematical exercise of making sure that the order is correct, whereas in the constant sum, the participant can be more intuitive. This also addresses some of the conjoint analysis criticism that has been voiced by e.g. Tim Glowa and Sean Lawson of North Country Research Inc. in the article “Discrete choice experiments and traditional conjoint analysis” which states that conjoint analysis does not have an acceptable way of accommodating “non-choice” of a stimulus.

Data collection

The survey was open for participants in the period 1st May 2002 to 21st August 2002, and the flow of participants into the survey can be seen in figure 2.

Figure 2 - Number of participants per month



Upon each participant's entry, additional sample statistical information was added to the entry: geographical region of the participant's country and whether the participant's country was English speaking. The utility statements mentioned in the prior paragraph were grouped into the following utility groups:

Usability
The pages are easy and logical to navigate and fast loading
There is a sitemap and a search function that allows free text searches
The page layouts have column width and fonts that are easily read
The pages are in my native language

Content
The website allows me to interact with other users or content providers
The content is reliable and is frequently updated
It is possible to locate the website through a search engine
The website has focused content and there is not a lot of other content such as ads

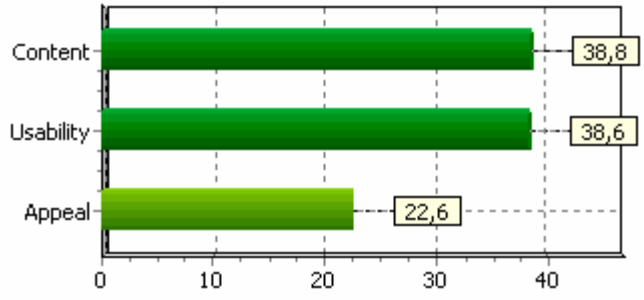
Appeal
The pages use effects such as animation and sound
The website has a streamlined design that leaves a good first impression
The website uses graphics to improve the understanding for the user
I feel safe from virus and other security violations

Data Analysis: Conjoint Analysis

The constant sum figures from the latter part of the survey will be used to analyze the data, as they are the most reliable because this exercise, in contrast to the ranking exercise, allowed the user to rate some statements as equally important and some unimportant. The ranking figures will be used to adjust and supplement the findings of the constant sum figures by allowing deeper insight into the left and right brain coordination of the participants.

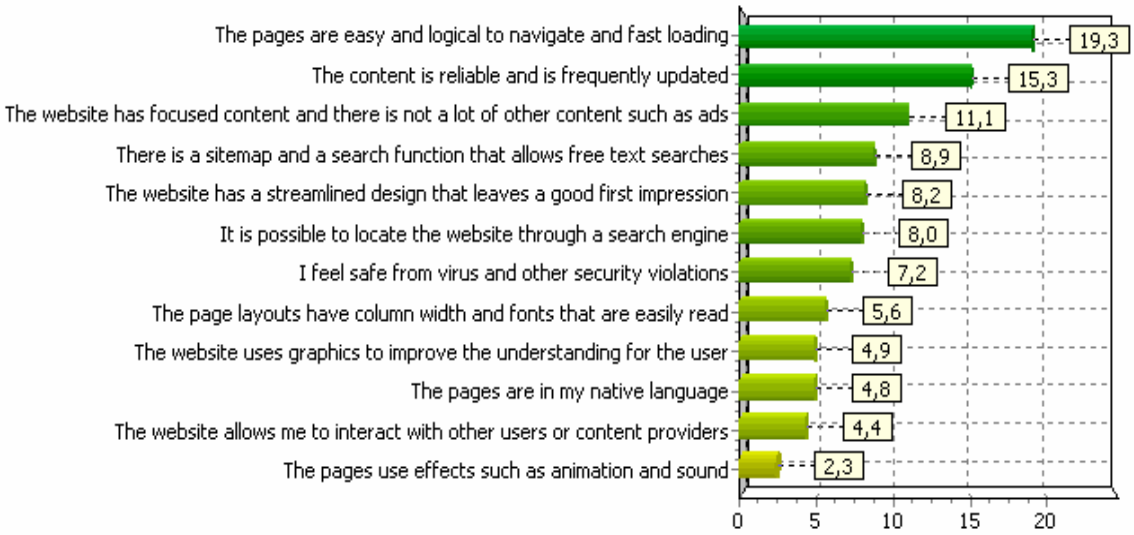
Overall, the data reveals a preference for content and usability compared to appeal. With the offset in the figures from the constant sum, as it can be seen in figure 3, it appears that almost the same average number of points has been assigned to these two stimuli groups across all participants.

Figure 3 - Average points assigned to the stimuli groups



It seems that, with this simple figure, we have found no evidence to reject the hypothesis. However, the overall balance of the content and the usability stimuli statement groups is dependent on the assignment of the stimuli statements into these groups. To prove that the outcome was not the result of bias in the categorizing, the stimuli groups have been expanded into a display of all utility statements as shown in figure 4.

Figure 4 - Average points assigned to the stimuli statements



Looking at figure 4, a few things come into mind. First it appear that there are four categories of stimuli statements: The first group is in the two digit average utility and has one usability and two content stimuli. The second group is the "plateau" ranging from 8,9 to 7,2 which contain two appeal, one content and one usability stimuli. The third group is also a "plateau" ranging from 5,6 to 4,4 which contains two usability, one appeal and one content stimuli. The fourth and least important stimulus is an appeal statement.

Most certainly we note that Jakob Nielsen's research into usability has much truth to it. We note that the top two usability stimuli: "the pages should be easy and logical to navigate and fast loading" and "There is a sitemap and a search function that allows free text searches" are 1st and 4th in overall scores. Additionally, one area where Jakob Nielsen urges "caution!" is the use of animation and sound (Nielsen, 2000: p143, p154), and we note that this is also the stimuli with the least utility associated overall .

That being said, we also note that the 2nd and 3rd places go to content stimuli. The content of a website should be reliable, frequently updated and free from irrelevant information e.g. ads. Again we note the analogy with Jakob Nielsen's HOME RUN, in that we have at least covered the first five letters in the top four statements:

High-quality content
Often updated
Minimal download time
Ease of use
Relevant to users' needs

So in other words, we seem to have revealed some of the essence of the HOME RUN approach, and additionally, we do indeed note that there is a strong balance between content and usability that in effect make them inseparable and, as we hypothesized, equally important.

Moving further down the stimuli we find that appeal does matter; a streamlined design that leaves a good first impression as well as making the user feel safe from virus and other security violations is important. However, it is noteworthy that virus and security does not make more than 7th position. According to other writers in the field of web design, such as Jennifer Fleming, feeling secure is paramount (Fleming, 1998: p. 106). We could take this as a sign that the participants in this sample group, of whom 95% are everyday computer users, have come to terms with the irrational fear of being on-line and are more concerned with actual threats. This rationale does not necessarily prove Jennifer Fleming wrong, but it simply means that the web user today takes security for granted; if in doubt, the user simply does not go there.

Reverting to the 5th position of a website having "a streamlined design that leaves a good first impression", we can conclude that at least this matters, and we will interpret this as a justification of the "**N**et-centric corporate culture" of the HOME

RUN, with the argument that any corporate is assumed to put value on integrity and a good first impression, thus if the corporate is not able to make this shine through on a website, it will not meet this criterion. One could of course argue that this goal could also be met by simply creating an appealing website without any corporate justification. However, from a holistic viewpoint, if one meets the N of Jakob Nielsen's HOME RUN, one will most logically also meet the "a streamlined design that leaves a good first impression" stimulus.

The only letter in the HOME RUN that does not stand out in figure 4 is the "**U**nique to the online medium". It appears that stimuli that could create an new experience using the online media, such as "graphics to improve the understanding for the user" and the use of "effects such as animation and sound", have fairly low utility scores. Instead of ruling the U out as being irrelevant, let us simply conclude that "free text searches", "easy and logical navigation", "sitemaps", "interaction with content providers" are also unique to the online media, and we could get a hint here that the path to a HOME RUN in terms of the on-line uniqueness does not go though fancy graphical designs, but through a structured process that ensures that the traditional aspects of web navigation are supported.

In summary, we conclude that the HOME RUN is a valid approach to making sure that a website meets the needs of a web user. However, we also note that no evidence was found to support a rejection of the hypothesis of this research since there is a balance in utility for stimuli that relate to content and usability; the utility scores of these stimuli are almost double the utility score for the appeal stimuli.

The above conclusions have been made based on an average across the entire sample group; therefore we note these conclusions do not necessarily apply on smaller sub-segments. In the following analysis we will dissect the sample group into segments with different behavioral attributes. We will aim to divide the users into a group that prefer content stimuli and a group that prefer usability stimuli; by doing this we hope to be able to reveal segments that behave differently. These groups can then be used to test the findings in the above conclusions and pinpoint the behavioral differences into specific stimuli preferences.

In figure 5, the participants have been displayed in a scatter chart where points of the two stimuli groups (content and usability) have been placed on the x- and the y-axis respectively. The participants who assigned more utility points to the content stimuli group are colored green and the participants who assigned more utility points to the usability stimuli group are colored red. As we can see, the two segments are divided on either side of the X=Y line. A few participants assigned the same utility to both the content and usability stimuli groups, and these participants are colored blue.

From figure 5 we now have 3 revealed segments:
Content segment: X>Y
Usability segment: X<Y
Balanced segment: X=Y

Figure 5 - Mapping of participants for the revealed segments

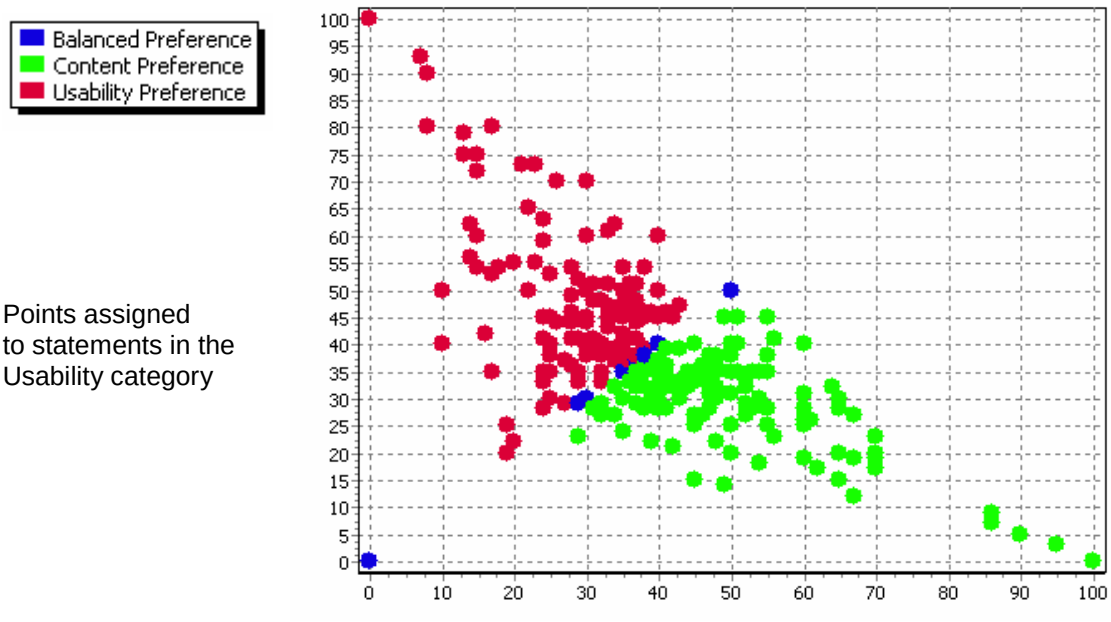
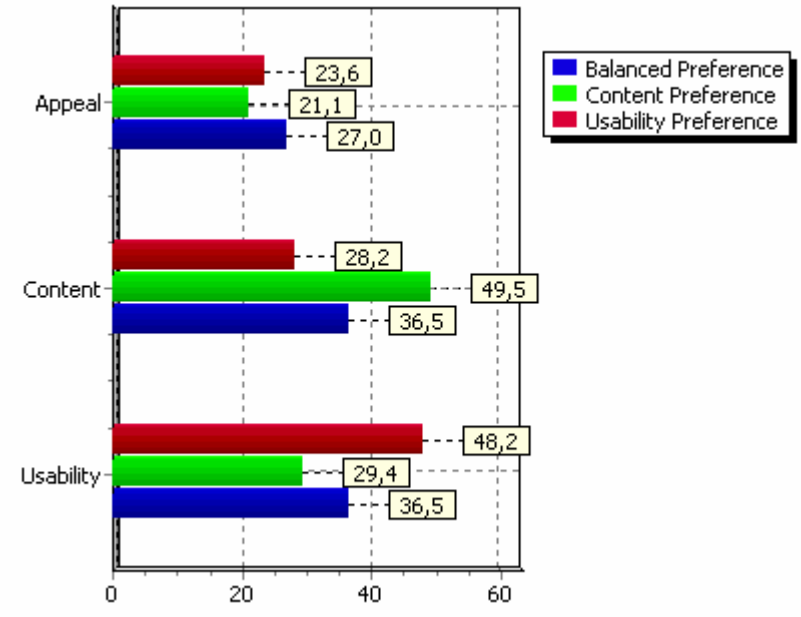


Figure 5 will give us an impression of the variance in the different revealed segments, however a more simplified view can be found in figure 6 where the revealed segments have been used as a further grouping for the stimuli groups.

Figure 6 - Average points per stimuli group for each of the revealed segments

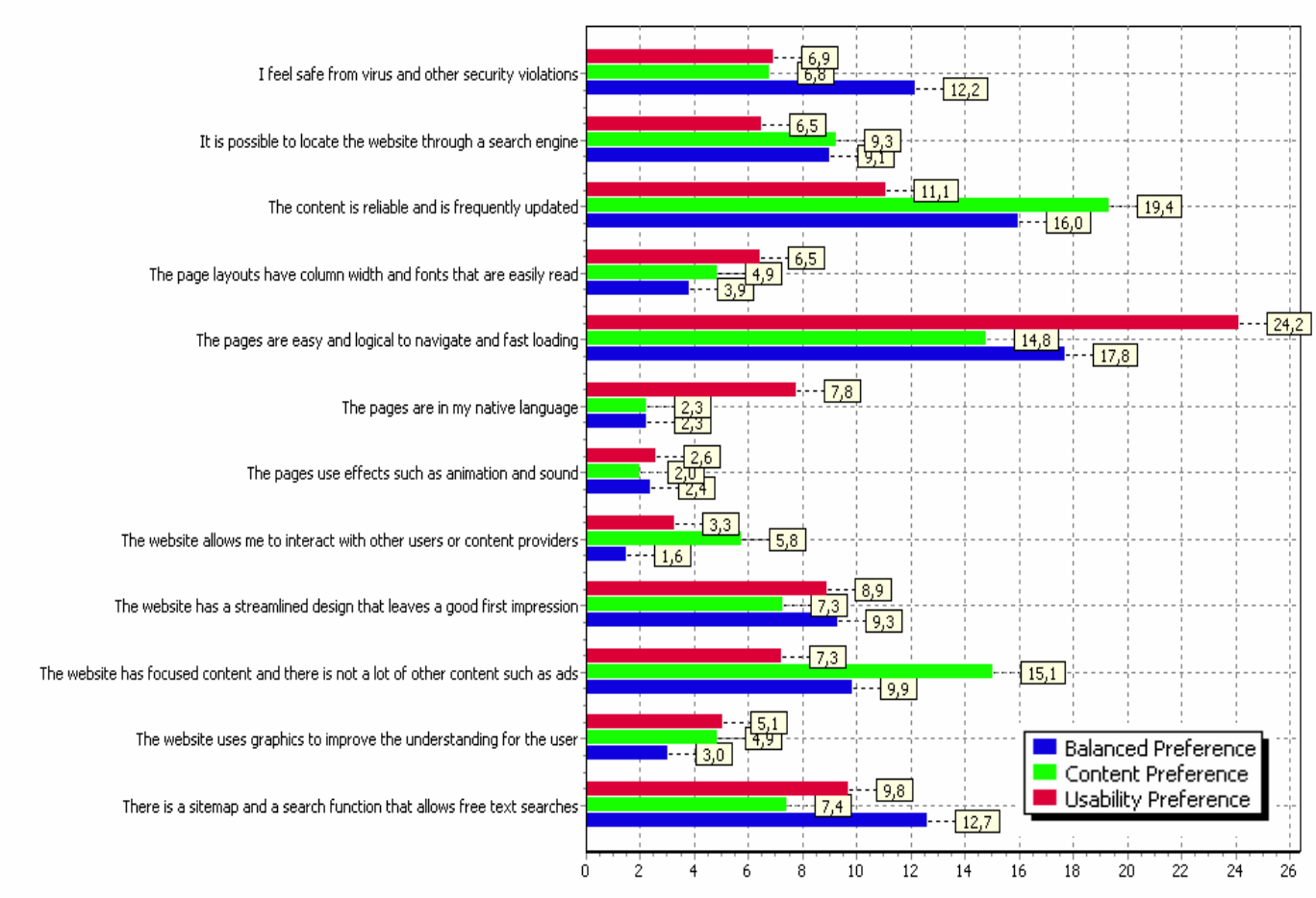


From figure 6 we can find the average points of each revealed segment in figure 5: content segment (49.5; 29.4), usability segment (28.2; 48.2) and balanced segment (21.1; 23.6). However, these geometrics are not nearly as interesting as the notable fact that the average of the content revealed segment is almost an exact mirroring of the usability revealed segment across the X=Y line. From a behavioral standpoint we can conclude that the users in these two revealed segments feel as strongly for usability stimuli as the other feels for content stimuli and vice versa.

It is noteworthy that the segmentation was in line with existing behavioral information in terms of the utility scores of the stimuli groups; the weakness of traditional clustering as voiced by Paul Green does not apply to this. He states that once a cluster is created, the analyst must still describe it (Green, Tull & Albaum, 1988: p. 585) but, as we noted in the previous paragraph, this is already embedded in the design of this research.

Expanding the stimuli groups into the individual stimuli, as seen in figure 7, shows the preferences that add up to the average.

Figure 7 - Average points per stimuli for each of the revealed segments



Although a number of things in figure 7 are obvious, a more structured approach to identifying variance across the revealed segments for the individual stimuli can be found in table 8 which contains the same information as figure 7.

Table 8 - Average constant sum distribution on stimuli for the revealed segments

Type	Question	Content	Usability	Balance
Usability	The page layouts have column width and fonts that are easily read	4,9	6,5	3,9
	The pages are easy and logical to navigate and fast loading	14,8	24,2	17,8
	The pages are in my native language	2,3	7,8	2,3
	There is a sitemap and a search function that allows free text searches	7,4	9,8	12,7
Content	It is possible to locate the website through a search engine	9,3	6,5	9,1
	The content is reliable and is frequently updated	19,4	11,1	16,0
	The website allows me to interact with other users or content providers	5,8	3,3	1,6
	The website has focused content and there is not a lot of other content such as ads	15,1	7,3	9,9
Appeal	I feel safe from virus and other security violations	6,8	6,9	12,2
	The pages use effects such as animation and sound	2,0	2,6	2,4
	The website has a streamlined design that leaves a good first impression	7,3	8,9	9,3
	The website uses graphics to improve the understanding for the user	4,9	5,1	3,0
	Sum	**100,0**	**100,0**	**100,2**

Top 1-3	Top 4-5	Top 6-7

For easier reference, colors have been assigned to the stimuli according to the utility score in the particular revealed segment. In other words, we can concentrate on the color's variances to assess similarities and differences between the revealed segments. We note the following:

The content revealed segment is mostly concerned with whether the "content on a website is reliable and frequently updated", and what distinguishes this segment from the others is also a high percentage of points assigned to the website having "a focused content without a lot of other content such as ads". Also, although rated as a fairly low utility, this segment is more interested than the other segments "to interact with the content providers".

The usability revealed segment is mostly concerned with the websites pages that should be "easy and logical to navigate and fast loading", and what distinguishes this segment most from the others is a high priority that "the pages of the website should be in the users' native language".

The small balanced revealed segment is generally midway between the two other segments, with the exception of a much higher preference for "feeling safe from virus and security violations" while using a website.

In general, all revealed segments prefer that the pages should be easy and logical to navigate and fast loading. The content should be reliable and frequently updated, and similarly these participants have assigned low utility to the website pages that use animation and sound. This is in line with our findings from figure 4.

With the argument that the constant sum figures are more reliable than the ranking for reasons mentioned earlier, the analysis so far has been concerned with the utility points assigned to the stimuli. However, let us now turn to the ranking of stimuli in table 9 to see what differences and similarities are revealed.

Table 9 - Average ranking of stimuli for the revealed segments

Type	Question	Content	Usability	Balance
Usability	The page layouts have column width and fonts that are easily read	7,4	6,4	7,5
	The pages are easy and logical to navigate and fast loading	2,2	1,5	1,9
	The pages are in my native language	10,3	8,2	9,3
	There is a sitemap and a search function that allows free text searches	5,3	4,7	3,9
Content	It is possible to locate the website through a search engine	6,0	7,2	6,2
	The content is reliable and is frequently updated	2,8	4,3	3,8
	The website allows me to interact with other users or content providers	7,0	7,8	8,5
	The website has focused content and there is not a lot of other content such as ads	5,0	7,5	7,3
Appeal	I feel safe from virus and other security violations	8,5	8,4	7,3
	The pages use effects such as animation and sound	9,6	9,2	9,6
	The website has a streamlined design that leaves a good first impression	5,9	5,1	4,8
	The website uses graphics to improve the understanding for the user	8,1	7,9	8,0

Top 1-3	Top 4-5	Top 6-7

By analyzing the information in Table 9, we find the two main trends from Table 8, where all revealed segments are focused on the pages being easy and logical to navigate and fast loading with reliable and frequently updated content. Additionally, all revealed segments consciously agree that the stimuli of animation and sound hold very low utility.

We also get confirmation from the ranking that the utility for not getting ads and other unrelated information is a conscious choice from the content revealed segment. However, the utility of the web pages being in the user's native language seems to have been downplayed by the usability revealed segment, as a conscious choice in ranking has left this stimuli at 10^{th} position in the ranking. Additionally, the usability revealed segment consciously cements its position in preferring the usability stimuli by ranking "that the web pages should be easily read in terms of columns width, font and layout" at 5^{th} position.

The balanced revealed segment has similar characteristics as in the constant sum, and we get confirmation of the conscious choice of prioritizing feeling safe from virus

and other security violations by ranking this stimulus higher than did the other revealed segments.

With the exception of the changing of preference for the web pages being in the user's native language for the usability revealed segment, we find confirmation in the findings from the constant sum in Table 8.

The difference from constant sum to ranking of the usability revealed segment with regards to the native language stimulus, can be interpreted as the difference between a conscious choice and a more intuitive choice. In other words, users in the usability revealed segment do not appear to be as left and right brain coordinated as the users in the content revealed segment.

This conclusion is in line with statements from Patrick Robinson of Robinson Consulting Inc, who stated in recent correspondence that, although constant sum should be most revealing, the ranking could be expected to reveal where people's heads are at regarding relative standings for the fine structure among all considerations, which could give insight into the respondents' perceptions and preferences.

In other words, when dealing with discrepancies between constant sum and ranking, we are also working in a grey area where perception is part of the puzzle. With these arguments we will trust the constant sum findings, yet note that a user in the usability revealed segment operates not only with a different preference from the content revealed segment, but also with another approach to a web application, that we, for want of statistical metrics in this research, will call perception.

…

In summary, we conclude that no evidence was found to support a rejection of the hypothesis that content and usability are equally important.

Jakob Nielsen's guidelines in his book "Designing Web Usability: The Practice of Simplicity" that presents a "HOME RUN" to be the vehicle for a successful website are valid, although not much emphasis is put on content referring to our new found knowledge that the hypothesis of this project was not rejected.

Although a HOME RUN will make a website good for an average of users, we find that there is a potential for enhancing the user experience based on the findings that some users have a higher preference for content and others for usability. The first group will prefer web content without unrelated content such as ads; the second will prefer web content that is in their native language. Furthermore, the first group appears to be more coordinated and conscious about what they expect, as there appear to be a stronger left and right brain coordination in this group.

In contrast to Jakob Nielsen's work, Jennifer Fleming's book from 1998: "Web Navigation: Designing the User Experience" has a higher degree of focus on the softer issues such as appeal, and she lists security as a major concern among internet users with reference to a survey conducted in 1997 (Fleming, 1998: p. 106). Although this research concludes that appeal, in terms of a streamlined design, is rated above average across all users, these 1997 findings appear to be out of sync with the paramount concerns of web users today. The reason for this could lie in the fact that users take security for granted, so they do not even consider frequenting websites that are not able to meet this simple demand. This suggests that the added effort to "feeling safe" on a website should rather be channeled to a transparent "being safe" for the users.

A summary of all the details of the analysis can be found in the "findings" section.

Data Analysis: Modeling User Behavioral Segments

Having described the users' preferences with the conjoint analysis, it is now time to see if it is possible to identify what kind of user we are most likely to meet if we build a website. We will aim to build a model that can identify whether a user prefers content or usability. Referring back to the previous section, we will attempt to determine whether a user is more likely to prefer content or usability. This will be done by data mining the revealed segments of content and usability which account for 93% (280 participants) of the entire sample. Once a model based on the data mining has been constructed, we will use the entire sample data to assess the accuracy of the model, hence its relevance.

The structure of the model will be a combination of Bayesian decision theory and a decision tree structure. The Bayesian approach assumes that it is possible to assign numerical weights to incidents, in the nature of betting odds, such that they obey certain requirements for consistency. These numerical weights, called prior probabilities, may be based on long-run "objective" experience with very similar problems; in other instances they may be more "subjective" (Green, Tull & Albaum, 1988: p. 65). In this case we will use objective weighting based on actual findings in the sample data. We will assume the sample data to be 100% representative of the population we are aiming to describe, however please note that, since we are dealing with populating a decision tree of prior probabilities, the final model does not assume that the sample and population are proportional in the segments of the decision tree. However, that being said, it should also be noted that, whereas the weighting is potentially correct, the sample behind the prior probability might vary differently from the actual population, thus the potential for statistical error will vary along with the size of the sample that a given segment in the decision tree is based upon.

The process of traversing the decision tree is recursive, meaning that the process will repeat over and over until there are no more branches that can extend the tree. In order to make the simplest set of rules, the decision tree process will start with the segmentations that are most significant in distinguishing whether a user prefers content or usability. Having decided the segmentation at a given level in the decision tree, the process is repeated on the new segments that have emerged. This process is then repeated over and over until there are no more significance, or rather any segments, that appear to have more than one preference groups of users. When this is the case, a final attempt to reveal preference segments hidden in the average made by combining all remaining segmentations into a matrix, should this final exercise reveal any more than one preference, then the branch is extended with those segmentations.

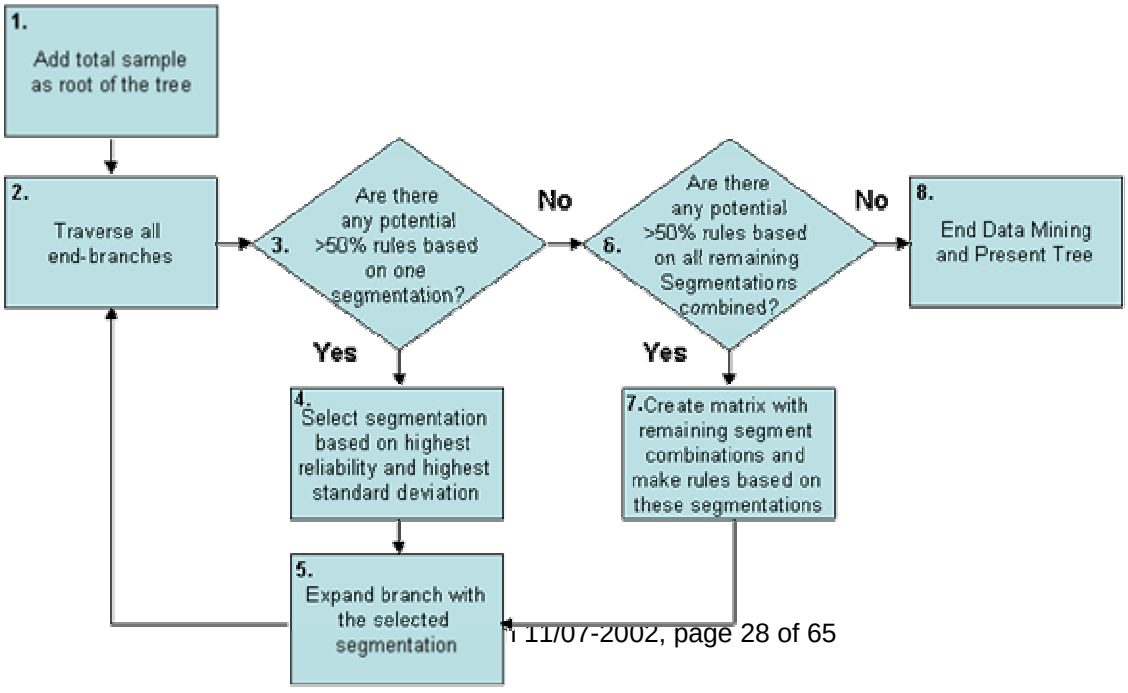
It is essential to assess which segmentation is most relevant for individual branches. For this purpose two figures are calculated:

1. Rule reliability, which is the sum of maximum of (content, usability) participants divided by the total number of participants in the segment. This figure will tell us to what extent a bivalent output for each segmentation will be descriptive of the total segmentations should the particular segmentation be used as a rule

2. Standard deviation for all participants who are in either the content or usability revealed segment. This figure will tell us about the spread in figures, and a high standard deviation will tell us to what extent the segmentation will be significant.

Rule reliability is the highest priority when selecting the segmentation for the branches of the decision tree. A rule with reliability less then 50% is not relevant at all since it would not add valuable information to the model. Standard deviation will tell us something about how significant the groupings based on a rule will be. A low standard deviation for the dataset will indicate that it is highly sparse, meaning that a large number of outcomes are based on fewer occurrences than a dense dataset. In other words, a dataset with a relatively low standard deviation compared to its competing datasets will be more statistically unreliable than one with a high standard deviation. As we will find in the modeling, there is only one instance where we need to prioritize a high standard deviation over higher rule reliability. That instance is when using the rule will make room for too much potential statistical error. Many of the segmentations have only 1 or 2 participants, in which case the decision to give priority to high standard deviation is made at the first level branches in the decision tree. This research has not formulated any formal rule as to when standard deviation should precede rule reliability and vice versa, since empirical tests to find an optimum are not possible given that there is only one occurrence in this research; however, in the Bayesian decision theory the subjective choice explained is justified as mentioned earlier.

Figure 8 - The data mining process flow

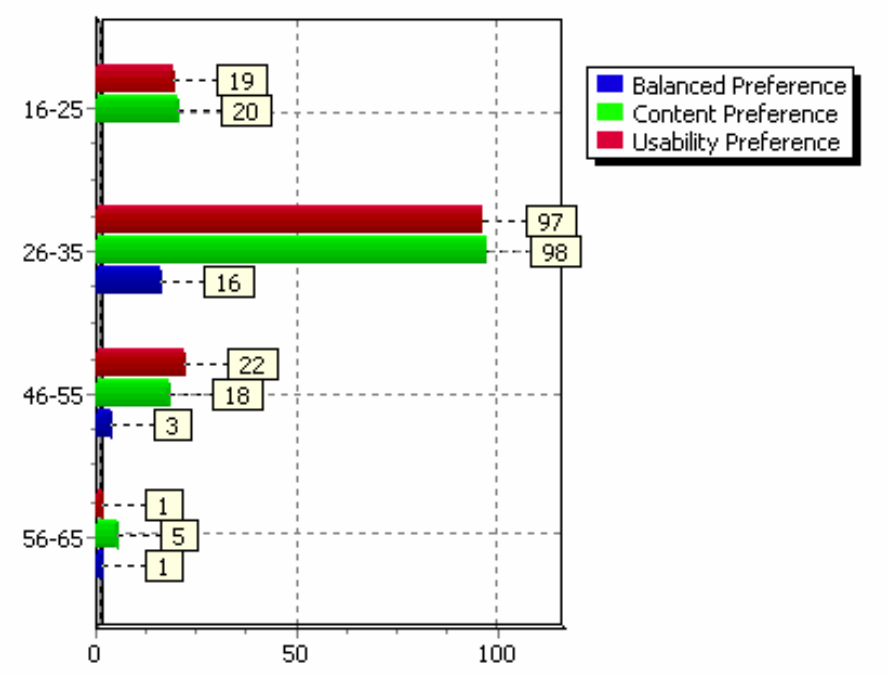


As we will note in figure 8, the branch expansion will not necessarily be based on the same segments from branch level to branch level, and indeed this is the strength of the decision tree approach. As this is a characteristic of the decision tree, we get the most significant segments expanded at the top levels. This means, as we will see in table 17 through 20, that we are able to select a depth of the tree depending on what we desire in terms of the mix of accuracy of rules and the sample sizes behind the rules.

An alternative to the data mining approach in figure 8 could be combining all segments in one matrix; however this approach would be inferior to the data mining approach, in that it would describe the behavior through a more complex rule set with as many rules as the total combinations of segments. Additionally the analyst would not have the option to select the mix of accuracy of rules and the sample sizes as explained above.

Let us turn now to walk through the selection of the first branch extension from level 0, the total sample. In the figures 9 through 14, combined with the calculations in tables 10 through 15, we now walk through step 3 in the figure 8 flow-chart:

Figure 9 - Age segmentation of the revealed segments



The coloring green for content and red for usability represents the conclusion a potential rule would make about the segmentation, should the rule be used to expand a branch.

Table 10 - "Age rule" reliability assessment

Age	Balanced	Content	Usability	Max
16-25	0	20	19	20
26-35	16	98	97	98
46-55	3	18	22	22
56-65	1	5	1	5
	Sum		**300**	**145**
	Standard deviation		**33,4**	
	Rule reliability			**48,3%**

Figure 10 - Connection speed segmentation of the revealed segments

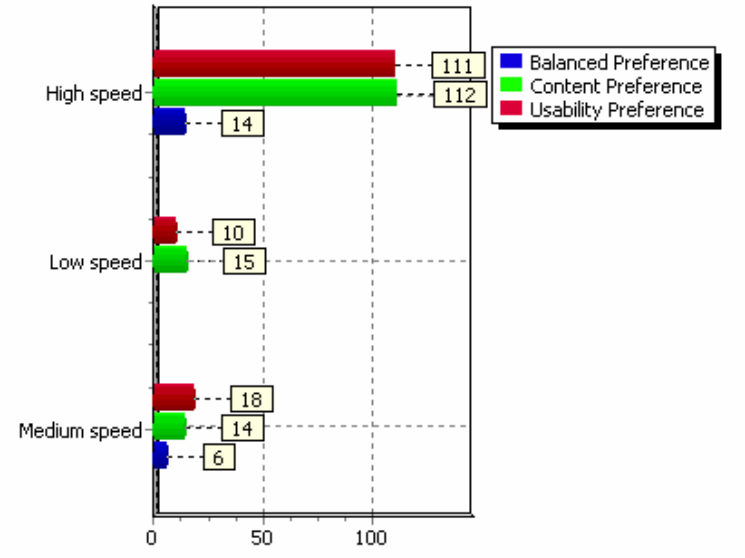


Table 11 - "Connection speed rule" reliability assessment

Connection Speed	Balanced	Content	Usability	Max
High speed	14	112	111	112
Low speed	0	15	10	15
Medium speed	6	14	18	18
	Sum		**300**	**145**
	Standard deviation		**42,1**	
	Rule reliability			**48,3%**

Figure 11 - Computer usage segmentation of the revealed segments

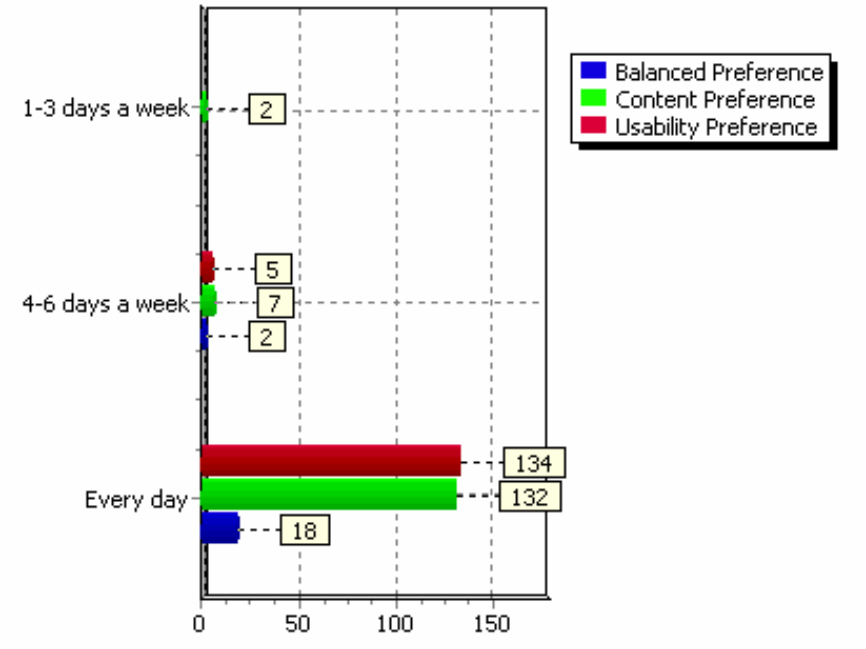


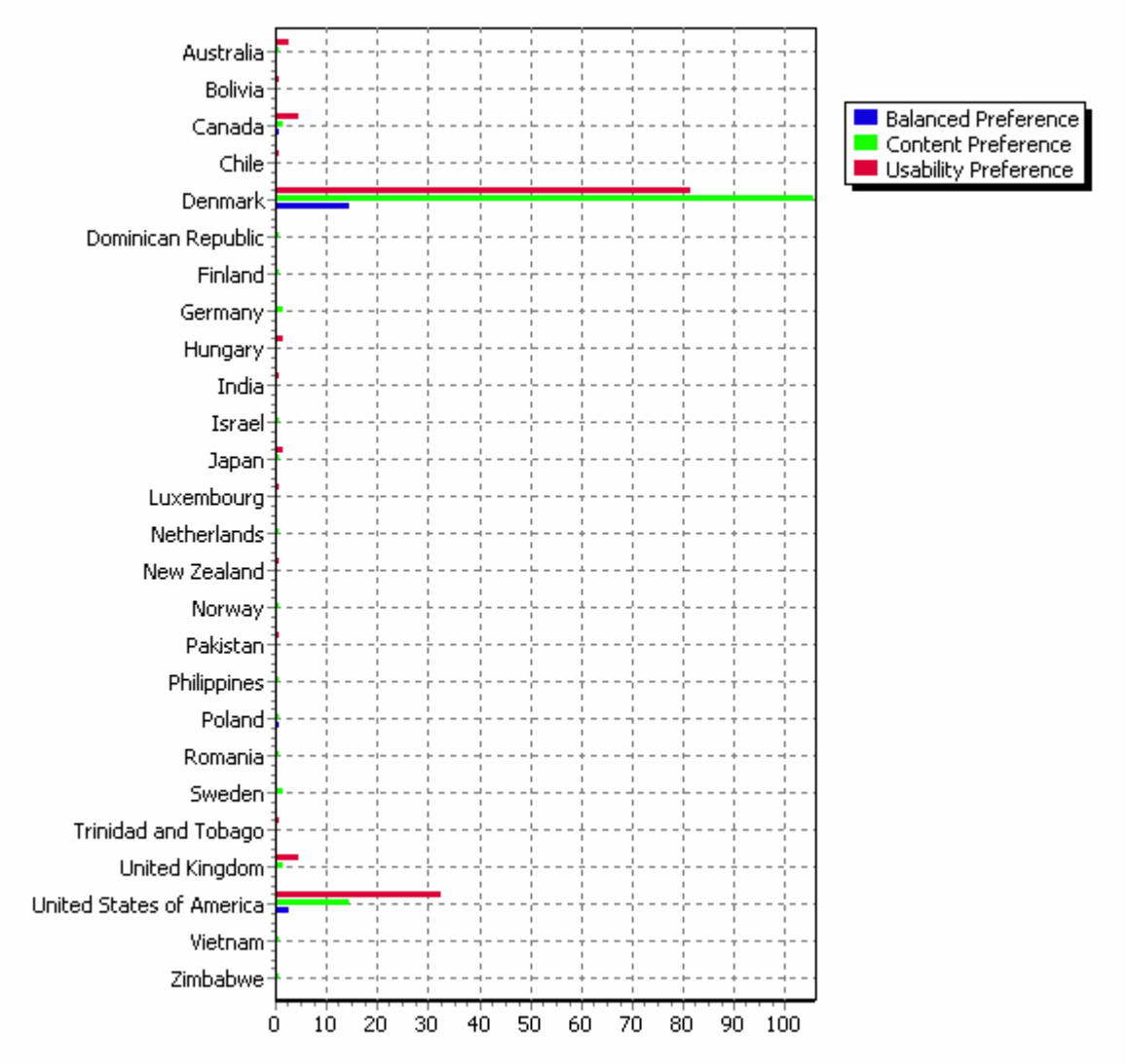
Table 12 - "Computer usage rule" reliability assessment

Computer Usage	Balanced	Content	Usability	Max
1-3 days a week	0	2	0	2
4-6 days a week	2	7	5	7
Every day	18	132	134	134
	Sum		**300**	**143**
	Standard deviation		**53,5**	
	Rule reliability			**47,7%**

As we will note, having gone through some of the most significant factors in terms of traditional usability design that relate to the experience of the user and the hardware setup, we find that none of these factors are potential rules since none of them are able to improve our chances for predicting the users' preference because none of them have a reliability in excess of 50%. In other words, we would be better off flipping a coin to determine whether users in a segment prefer content or usability.

There are some more encouraging findings ahead…

Figure 12 - Country segmentation of the revealed segments



We note from the graph in figure 12 the high concentration of participants from Denmark and the United States in the sample group.

Table 13 - "Country rule" reliability assessment

Country	Balanced	Content	Usability	Max
Australia	0	1	3	3
Bolivia	0	0	1	1
Canada	1	2	5	5
Chile	0	0	1	1
Denmark	15	106	82	106
Dominican Republic	0	1	0	1
Finland	0	1	0	1
Germany	0	2	0	2
Hungary	0	0	2	2
India	0	0	1	1
Israel	0	1	0	1
Japan	0	1	2	2
Luxembourg	0	0	1	1
Netherlands	0	1	0	1
New Zealand	0	0	1	1
Norway	0	1	0	1
Pakistan	0	0	1	1
Philippines	0	1	0	1
Poland	1	1	0	1
Romania	0	1	0	1
Sweden	0	2	0	2
Trinidad and Tobago	0	0	1	1
United Kingdom	0	2	5	5
USA	3	15	33	33
Vietnam	0	1	0	1
Zimbabwe	0	1	0	1
Sum			**300**	**177**
Standard deviation			**15,4**	
Rule reliability				**59,0%**

In the tabular form we note the low standard deviation, yet high rule reliability. The usage of this rule holds a high potential for categorizing the users into either content or usability preferring, but it would more or less a comparison of Danish and US users. This notion will restrain us from using country for segmentation and, as we will notice later on, the usage of the calculated sample statistics will allow us to build a more generic and globally appropriate rule.

Figure 13 - Regional segmentation of the revealed segments

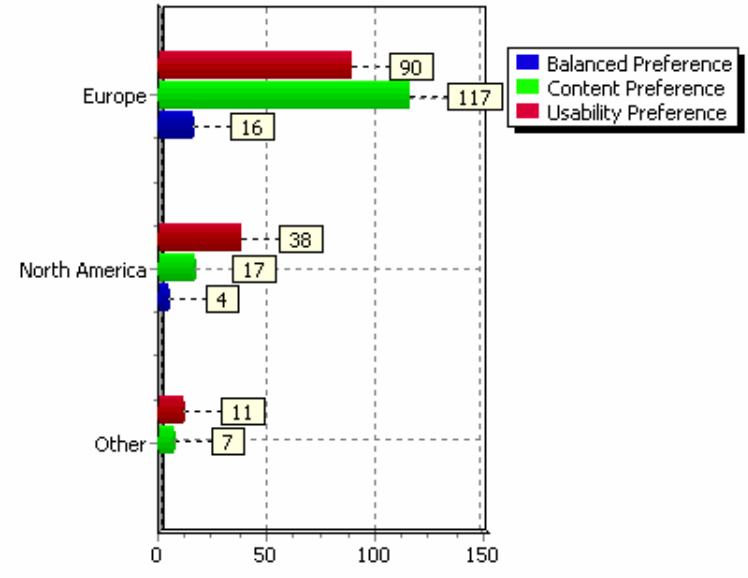


Table 14 - "Region rule" reliability assessment

Region	Balanced	Content	Usability	Max
Europe	16	117	90	117
North America	4	17	38	38
Other	0	7	11	11
	Sum		**300**	**166**
	Standard deviation		**39,4**	
	Rule reliability			**55,3%**

Figure 14 - Language segmentation of the revealed segments

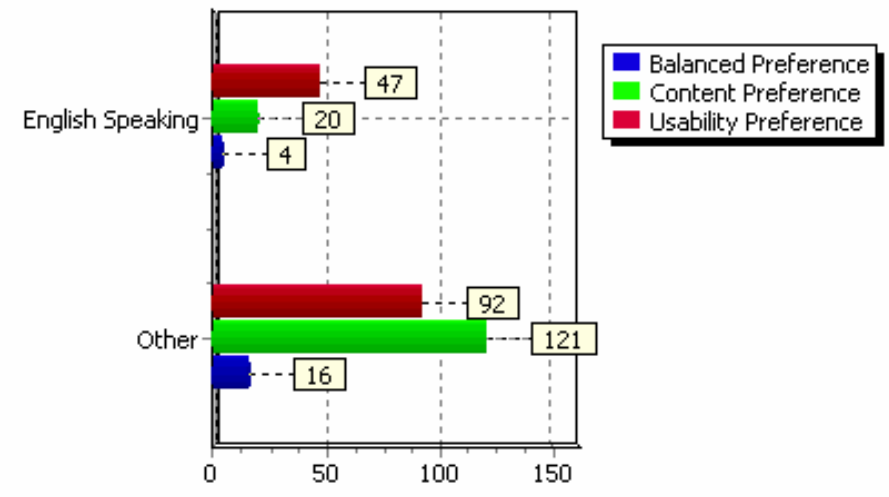


Table 15 - "Language rule" reliability assessment

Language	Balanced	Content	Usability	Max
English Speaking	4	20	47	47
Non-English Speaking	16	121	92	121
	Sum		**300**	**168**
	Standard deviation		**42,8**	
	Rule reliability			**56,0%**

Based on a comparison of all potential rules and bearing in mind the comments made on the potential "country rule" we note that the "language rule" based on a high reliability is the best fit. We also note rule reliability should count higher than standard deviation, as we saw that "Computer usage rule" had the highest standard deviation, and yet was unreliable (<50% reliable).

As noted in the recommendation section, this approach could be used for pursuing size of segments as opposed to a bivalent choice as we do in this case. When pursuing size, standard deviation would be a valid priority as it would help identifying the segments that are most significant for having either a high or low figure; also in this case reliability would not exist as it refers to the validity of a bivalent choice.

Having selected the "language rule" as the most reliable, let us now revert a moment to the "country rule". The concern could be that the "language rule" is simply a pseudonym for a comparison of Denmark and the United States as we recall the high concentration from figure 12. However this "weighted country rule" as shown in table 16 is not competitive with the "language rule".

Table 16 - "Weighted country rule" reliability assessment

Country	Balanced	Content	Usability	Max
Denmark	15	106	82	106
USA	3	15	33	33
	Sum		**254**	**139**
	Standard deviation		**38,2**	
	Rule reliability			**54,7%**

We can now conclude that the "language rule" is not just a reflection of a rule based on the two largest countries in terms of participants, since it has a higher reliability than the "Weighted country rule", which means that the remaining less significant clusters add to the accuracy of the "Language rule", thus makes it more "true". Therefore the "Language rule" is truly the best segmentation for branching to the first level in the decision tree.

Before we continue the flow of figure 8, let us just conclude the following based on the findings so far:

If one is designing a website, review the language spoken in the user's countries. If this is English, position the HOME RUN with an emphasis on Usability, if it is not English position the HOME RUN with an emphasis on content.

In other words: if we were just to select one way of segmenting the users in this project, segmenting them on the language spoken in their country would be the best criterion on which to assess the users' preference for either content or usability.

Reverting back to the flow-chart in figure 8, we should now repeat the process as done through figures 9 - 14 and tables 10 – 15, for the two branches of English and non-English speaking users to identify the next segmentation for each branch. We will find that for English speaking users it will be segmenting on age and for non-English speaking users it will be segmenting by connection speed. At this point we will note, as mentioned earlier, the strength of the decision tree approach in handling the multiplicity of behavioral segments as they do not necessarily need to comply with the same descriptive rules.

The information that has led to the creation of the entire decision tree model from level 2 to level 4 can be found in appendix 2. However, with this explanation of the data mining process, we will skip to the findings of the computerized mining process.

Table 17 - Simple rule set based on data mining

If ...	Then ...	Hits	# Correct	Reliability
1. Language=English	Usability	71	47	66%
2. Language=Non-English	Content	229	121	53%
Sum		**300**	**168**	**56%**
Average sample per rule		**150,0**		

From the simple statements in table 17 we are able to predict the preferences of all users with an accuracy of 56%. In the following tables we enhance these rules as we extend the branches of the decision tree. Please note that the rules should be applied so that, if a participant meets more than one rule, the rule with the highest number to the right should be selected. For readers who are computer programmers, one could say that a proper way to display the rules in computer terms would be sorted descending by the rule number with an "else" between them. However, as we display the rules in the decision tree in figure 15, hopefully this will clarify the usage of the rules even further.

Table 18 - Simple rule set with two amendments based on data mining

If ...	Then ...	Hits	# Correct	Reliability
1. Language=Non-English	Content	208	116	56%
2. Language=English	Usability	66	46	70%
3. Language=Non-English and Connection=Medium speed and Computer Usage=Every day and Age=26-35	Usability	21	12	57%
4. Language=English and Age=56-65	Content	5	3	60%
Sum		**300**	**177**	**59%**
Average sample per rule		**75,0**		

We note in table 18, that we improve the overall accuracy of the rule set by adding extra factors into the simplified rule.

In table 19 we find the entire rule set based on data mining at all branches of the decision tree. This gives us an overall accuracy of 62% in predicting the users' behavioral preferences.

Table 19 - Full rule set based on data mining

If ...	Then ...	Hits	# Correct	Reliability
1. Language=Non-English	Content	199	114	57%
2. Language=English	Usability	65	47	72%
3. Language=Non-English and Connection=Medium speed and Age=26-35 and Computer Usage=Every day	Usability	21	12	57%
4. Language=Non-English and Connection=High speed and Region=Other and Age=26-35	Usability	7	5	71%
5. Language=English and Age=56-65 and Region=North America	Content	4	3	75%
6. Language=English and Age=26-35 and Connection=Low speed and Region=Europe	Content	1	1	100%
7. Language=English and Age=46-55 and Connection=Medium speed	Content	1	1	100%
8. Language=Non-English and Connection=Medium speed and Age=16-25 and Region=Other	Usability	1	1	100%
9. Language=Non-English and Connection=Medium speed and Age=26-35 and Computer Usage=4-6 days a week	Usability	1	1	100%
Sum		**300**	**185**	**62%**
Average sample per rule		**33,3**		

We note that describing the sample with only 9 rules is significant in obtaining this accuracy. One could argue that it would be possible to build a model by simply making a table with all combinations of factors and the optimal choice for each combination. However, this approach would leave a complex set of specific rules, in

this case 43 which would be almost 5 times as many. Furthermore this would prevent us from ranking the importance of the segments as we will see in figure 15, where we can apply the rules at different levels, with each level adding to the success rate of the model, yet with a higher potential for statistical inaccuracy. In this selected approach the user is allowed to apply the easily understandable model to the extent he or she is comfortable with.

In addition to expanding the decision tree rules to their fullest as seen in table 19, we can also select to apply our final almost “Platonian” wisdom. If we take into consideration the segments, where we know that there is not a finite answer as to the behavioral segment of the user, and simply do not answer those, we are able to further add to the accuracy of the model. This approach will be feasible as long as we do not desire a finite answer for one of the excluded segments; in this context please note that most of the excluded segments have a high potential for statistical error as most of them have only two users. In table 20 we find the full set of rules including 7 exception rules. This approach allows us to describe 86% of the sample with 64% accuracy.

A summary and more user friendly display of the decision tree can be found in the findings section.

Table 20 - Full rule set based findings of data mining with exceptions

If ...	Then ...	Hits	# Correct	Reliability
1. Language=Non-English	Content	163	97	60%
2. Language=English	Usability	61	45	74%
3. Language=Non-English and Connection=Medium speed and Age=26-35 and Computer Usage=Every day	Usability	21	12	57%
4. Language=Non-English and Connection=High speed and Region=Other and Age=26-35	Usability	7	5	71%
5. Language=English and Age=56-65 and Region=North America	Content	2	2	100%
6. Language=English and Age=26-35 and Connection=Low speed and Region=Europe	Content	1	1	100%
7. Language=English and Age=46-55 and Connection=Medium speed	Content	1	1	100%
8. Language=Non-English and Connection=Medium speed and Age=16-25 and Region=Other	Usability	1	1	100%
9. Language=Non-English and Connection=Medium speed and Age=26-35 and Computer Usage=4-6 days a week	Usability	1	1	100%
Sum		**258**	**165**	**64%**
Average sample per rule		**28,7**		

If ...	Then ...	Hits
E1. Language=Non-English and Connection=High speed and Region=Europe and Age=16-25 and Computer Usage=Every day	Exclude	26
E2. Language=Non-English and Connection=High speed and Region=Europe and Age=26-35 and Computer Usage=4-6 days a week	Exclude	6
E3. Language=English and Age=26-35 and Connection=Low speed and Region=Other	Exclude	2
E4. Language=English and Age=46-55 and Connection=High speed and Computer Usage=4-6 days a week	Exclude	2
E5. Language=English and Age=56-65 and Region=North America and Connection=High speed	Exclude	2
E6. Language=Non-English and Connection=Low speed and Age=16-25	Exclude	2
E7. Language=Non-English and Connection=Low speed and Region=Europe and Age=46-55 and Computer Usage=Every day	Exclude	2
Sum		**42**

Limitations

In relation to the calculation of the language sample statistic, Canada has been deemed an English speaking country even though it is, according to the CIA fact book, partly French: English 59.3% (official), French 23.2% (official), and other 17.5%. However, as the language proved to be the best criterion for determining the users' preferences, this inaccuracy will not affect the findings of this project. It could however be interesting for future research to go deeper into the language preference issue by involving other languages to clarify the preferences even more.

Another weakness that was voiced by survey participants was the way the question of country was used. In the survey it was not clear whether the participant was supposed to reply with his or her nationality or country of residence. This problem was of course specific to people living outside of their country of origin, but it is certainly important to take note of this weakness and to be more specific in future research on the subject. The data used in this project does not tell us how big an issue this is, as we note that country served as an invaluable source in segmenting on language and region.

We should note that 300 participants is very far from the entire population of web users. However, one should bear in mind that the sample size for a selection based on simple random selection in theory is sufficient as long as there is a high degree of consistency among the sample and the conclusions based upon it; in other words, the assessment of a sample size's relevance is made based on the variance in the sample compared to the conclusions based upon it.

The consistency in the segmentation based on language, and the fact that language proved not to be just a decoration of the major country clusters as shown in table 16, will speak for it self. We will argue that the sample was sufficient to describe preferences across both language segments in terms of overall content and language preferences, thus the sample was at least sufficient to support a fair testing of the hypothesis as well as identifying that language is paramount in determining the overall behavioral segment of a user into either a content or a usability segment. However, we will grant that the outer branches of the decision tree in figure 15 should be treated with caution, as we note the decrease in sample size, which differs from branch to branch.

Another potential limitation could arise from the conjoint analysis. This has received criticism and has been deemed inferior to discrete choice models as, according to Tim Glows and Sean Lawson in "Discrete choice experiments and traditional conjoint analysis", it is not possible to deem a stimulus to have no importance. In this project this weakness was only present in the ranking, whereas the constant sum distribution gave the participants the 'no selection' choice. In general it appears that the conjoint analysis approach in terms of sample data gathering was successful in

this project as it was possible to instruct 300 participants to answer the survey autonomously, and the data collected were relevant to meet the goals of this project.

Findings

Recalling our initial hypothesis:

Content and Usability are equally important when designing web applications

I believe that this research has provided a fair test of this hypothesis and found no evidence that support a rejection as demonstrated in both figures 3 and 4. The significance of this finding is that we are now able to bridge the gap of lacking priority of issues in Jakob Nielsen's HOME RUN writings (Nielsen, 2000: p380, p382). By putting a figure on the actual priority, we now have a tool for prioritizing resources in projects that involve web design. Additionally, we note that figure 3 and 4 cast new light on the force field between content, usability and appeal shown in figure 1, and again the notion that content and usability are each assigned almost double the amount of utility points compared to appeal also suggests that priority and resource allocation to content and usability should be higher than to appeal in web design projects.

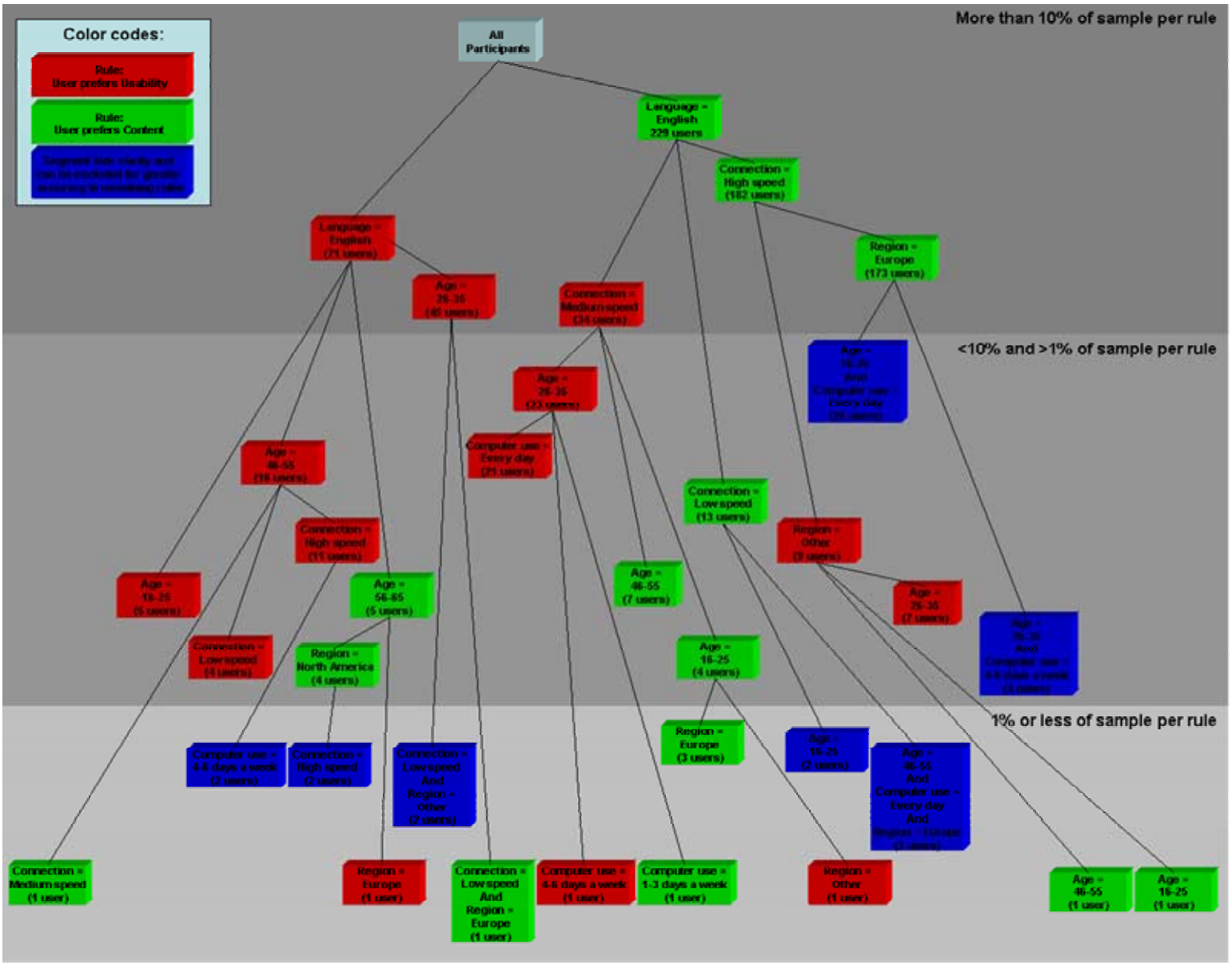
In the deeper research into the specific force field between content and usability, we found that two generic guidelines for designing websites: "The pages should be easy and logical to navigate and fast loading" and in addition, "the content should be reliable and frequently updated" as we learned by interpreting tables 8 and 9.

Below these generic guidelines we revealed two segments that together accounted for 93% of the entire sample: a revealed segment of users who gave a higher value to content and a revealed segment of users who gave a higher value to usability. The characteristics of the users who valued content were that they preferred a website that had "a focused content without a lot of other content such as ads". Additionally, although rated with lower utility, this segment is more interested than the other segments "to interact with the content providers". The most significant characteristic for the users who valued usability was that they believed "the pages of the website should be in the users' native language". In other words, users are negative to content other than what they are looking for, such as ads, and the usability users want a website in their native language. The latter rule could be elaborated on by saying that users who speak English seem more reluctant to read languages other than English. One could also speculate, that the fact that non-English speaking users seem to be more negatively sensitive to ads on websites compared to those who are English speaking has its roots in more cultural depth.

The interesting finding other than the actual preferences of these revealed segments was that the best way to predict whether a user will prefer either content or usability is by knowing the language spoken in the user's country; if this is English, the user is more likely to have a usability preference and if the language is non-English then the user is more likely to have a content preference. It is possible to predict the preferences with a 56% accuracy from knowledge of the user's language, however

by applying knowledge of the user's age, daily computer usage, internet connection speed and country, it is possible to predict the user's preference with 64% accuracy. Users with either preference will behave according to their preference

Figure 15 - The User Preference Category Model (UPCM)



A larger version is available in appendix 3 for easier reading of detail information.

In figure 15, all rules have been displayed in a decision tree, including a few exceptions where the findings of this research only indicate that no solid preference can be detected. In the figure an assessment of a given rule's statistical relevance is also indicated by the shading of the background. Additionally, the rules have been

arranged top to bottom in accordance with how many users were in the sample that determined the location of the rules in the decision tree.

Referring back to Jakob Nielsen's guidelines from the conference in Copenhagen on 16th May 2002, that a sample of 4 users is often the optimal in terms of cost and benefit, only the rules at the bottom with the least shading do not match this inaccuracy criterion as they cover 3 or fewer participants in the total sample.

The decision tree findings expand the notion that language is the best indicator of a user's preference for either content or usability, and it allows designers of websites to position their user's preferences based on knowing the facts: user's age, daily computer usage, internet connection speed and country. The decision tree can be used as a yardstick for the priority of content and usability within the definitions in this project. The decision tree has been designed so that the knowledge it provides can be applied on the level the reader chooses, and the information can be used on a given junction of branches or at the end of branches depending on the detail and statistical quality desired.

Aside for the behavioral findings in this project, we note the efficiency of the decision tree approach in describing user behavior; in particular we note the success of the approach which involves both rule reliability, standard deviation and a matrix supplement. The combination of a matrix approach with the traditional decision tree branching is effective for the uncovering of deep interrelationships where the traditional decision tree approach would not have detected these.

Conclusion

Summary and conclusions

I believe that this project demonstrated the problem of Jakob Nielsen's paradox. First of all it demonstrated that content and usability overall are perceived as equally important as shown in figure 3, but it also gave an insight into what drives the users' preferences. Thus the hypothesis that this should be the case was not rejected.

It is remarkable that so much of the research into usability design has focused on the physical characteristics of the users. This project demonstrates that the major determinant of a user's preferences is the language spoken in the user's country. This research does not reveal if this relationship is causal, but one can speculate that at least for the preference of content there is a deeper cultural relationship in terms of the negative sensitivity to ads.

The findings of this project are relevant as they open a new way of distinguishing users that is more globally oriented compared to a generic design that assumes that all users regardless of language have the same preference for content and usability. It provides a tool for prioritizing resources when developing a website and it tells us about users' behavioral preferences, not in general terms but as complicated interrelations as shown in figure 15. Although an 80/20 rule was desired, we made it roughly a 2/3 rule with reference to the 64% accuracy we obtain by applying all rules as shown in table 20 and figure 20. These rules should, if applied wisely, assist in establishing the priorities as well as serving as a platform or at least inspiration for future research into the behavioral science of web users.

On the technical side, we note the strength of the methodology developed during this research project for data mining and presenting the users' behavioral preferences. We note that this methodology can be applied in a number of other analytical aspects, in particular with conjoint analysis that is characterized by the descriptive approach to stimuli and utility. The decision tree output goes hand in hand with the fact that conjoint analysis is seeking to capture users' behavioral parameters, thus serves as a good tool for the display and modeling of behavior. Additionally, the mathematic combinations used to extend the decision tree's branches are powerful for mining into relevant depth. We noted in this research, and with reference to Jakob Nielsen, that a sample of 4 participants, which is only 1% of the total sample, can be relevant.

Recommendations

Based on the finding that content is equally as important as usability, I believe that future usability testing should include a much more structured testing of whether the content meets the needs of the web user.

Additionally, the knowledge found in this project, that the language of the web user can be the key to revealing a number of other preferences, as well as the detailed behavioral knowledge found in figure 15, can be used to analyze and apply the knowledge of this project in future designs.

It would be interesting to see more in-depth analysis of the language phenomenon in future research, as we are probably only looking at the tip of the iceberg in understanding web users' behavior. The language could be an indicator for some interesting cultural similarities that are waiting to be discovered by behavioral scientists. If research similar to this were done on a sample that had higher larger segments by users that speak other widely adopted languages e.g. Spanish, Portuguese, French or Chinese, it would reveal if the language phenomenon was an English/non-English phenomenon or if it applies to everyone who speaks one of the widely adopted languages.

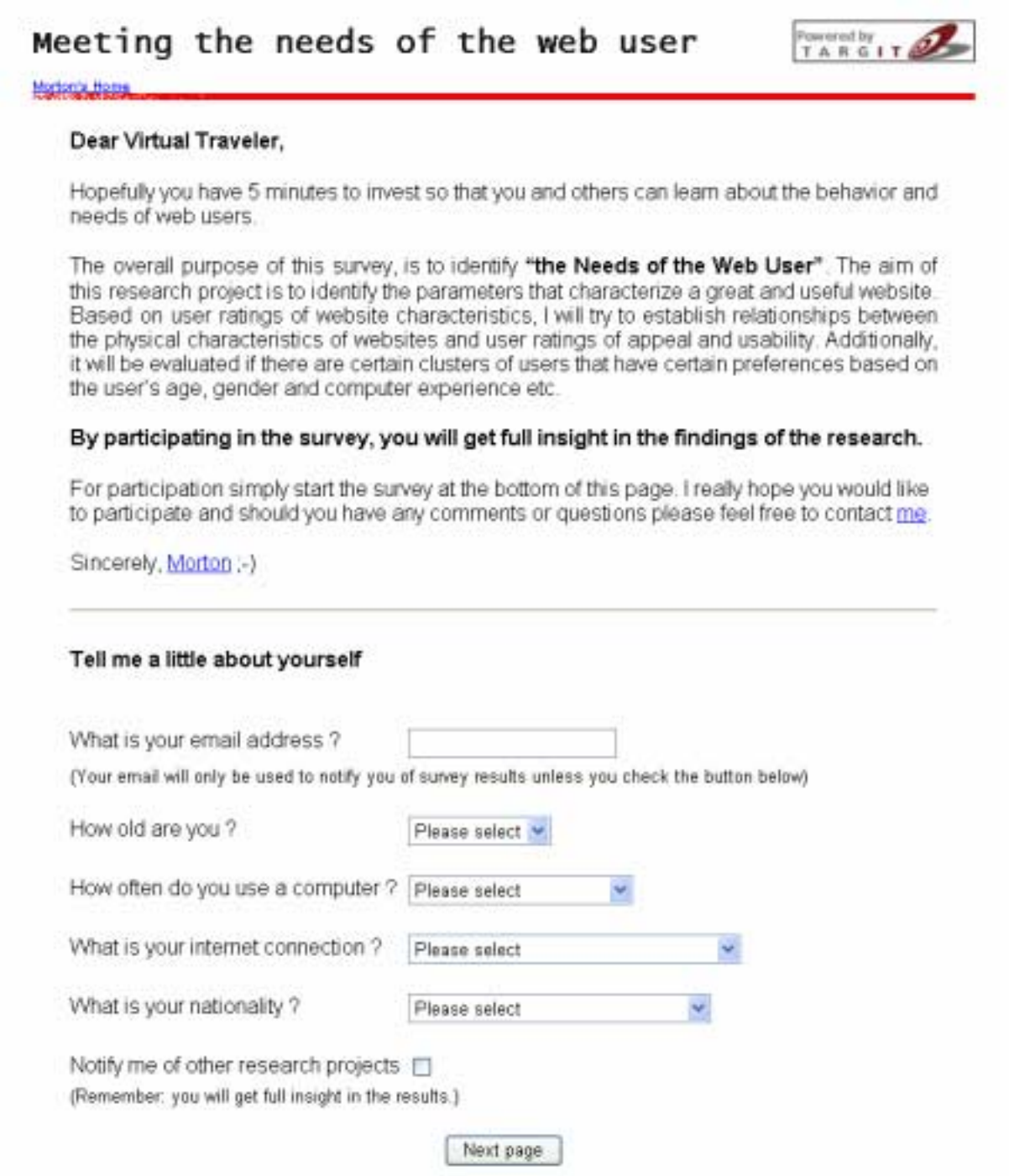
A deeper research into more user parameters such as e.g. gender would also be desirable and add to the value of the knowledge generated in this project.

Another interesting issue is to pursue the discrepancy of in left and right brain coordination that was observed among the users with a preference for usability; perhaps such research could uncover more mental insight, and add an entire new dimension to the way users are categorized.

The methodology for sampling, data mining and presentation can be used for other behavioral studies. The data mining methodology can also be used to mine for other figures than a bivalent answer as in this research. If seeking to pursue the size of segments rather than a behavioral output, we can use high standard deviation as a criterion for creating branches. This approach would be an alternative to clustering, and would be more descriptive in the output of the revealed segments of behavior.

Appendixes

Appendix 1 - The Web Survey



Meeting the needs of the web user

Powered by TARGIT

Morten's Home

Dear Virtual Traveler,

Hopefully you have 5 minutes to invest so that you and others can learn about the behavior and needs of web users.

The overall purpose of this survey, is to identify **"the Needs of the Web User"**. The aim of this research project is to identify the parameters that characterize a great and useful website. Based on user ratings of website characteristics, I will try to establish relationships between the physical characteristics of websites and user ratings of appeal and usability. Additionally, it will be evaluated if there are certain clusters of users that have certain preferences based on the user's age, gender and computer experience etc.

By participating in the survey, you will get full insight in the findings of the research.

For participation simply start the survey at the bottom of this page. I really hope you would like to participate and should you have any comments or questions please feel free to contact me.

Sincerely, Morton ;-)

Tell me a little about yourself

What is your email address ?

(Your email will only be used to notify you of survey results unless you check the button below)

How old are you ? Please select

How often do you use a computer ? Please select

What is your internet connection ? Please select

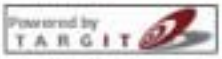
What is your nationality ? Please select

Notify me of other research projects ☐

(Remember: you will get full insight in the results.)

Next page

Meeting the needs of the web user



Morten's Home

Step 1 of 2

Below you will find 12 statements that can be said about a broad number of websites. By using the arrows you can move each statement up and down.

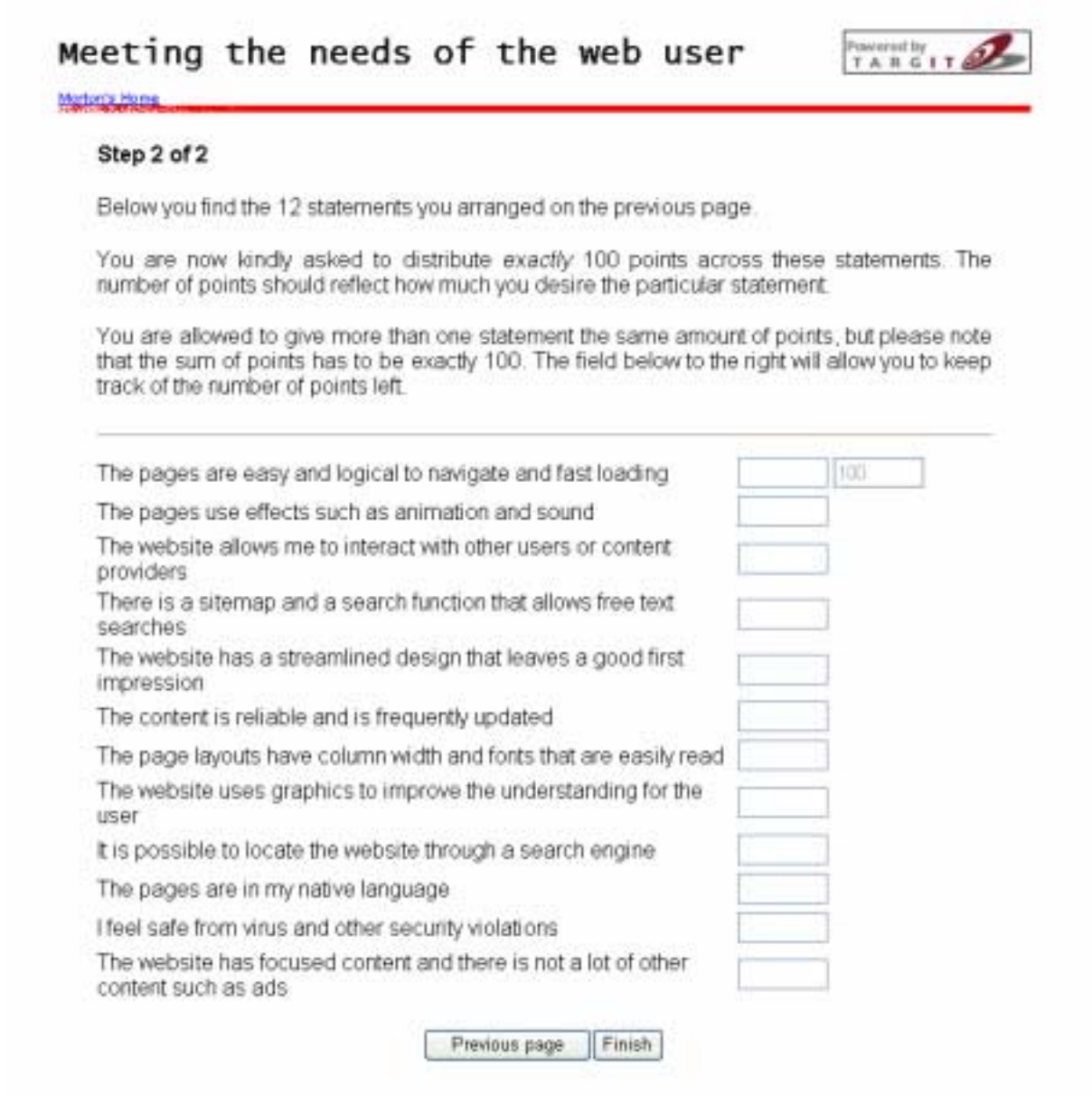
By thinking about what you like most on the websites you like to visit, please arrange the statements top to bottom in an order that places the most important statement on top and the least important statement on the bottom.

Most Important

- The pages are easy and logical to navigate and fast loading
- The pages use effects such as animation and sound
- The website allows me to interact with other users or content providers
- There is a sitemap and a search function that allows free text searches
- The website has a streamlined design that leaves a good first impression
- The content is reliable and is frequently updated
- The page layouts have column width and fonts that are easily read
- The website uses graphics to improve the understanding for the user
- It is possible to locate the website through a search engine
- The pages are in my native language
- I feel safe from virus and other security violations
- The website has focused content and there is not a lot of other content such as ads

Least Important

Previous page | Next page



Meeting the needs of the web user

Powered by TARGIT

Morten's Home

Step 2 of 2

Below you find the 12 statements you arranged on the previous page.

You are now kindly asked to distribute *exactly* 100 points across these statements. The number of points should reflect how much you desire the particular statement.

You are allowed to give more than one statement the same amount of points, but please note that the sum of points has to be exactly 100. The field below to the right will allow you to keep track of the number of points left.

The pages are easy and logical to navigate and fast loading		100
The pages use effects such as animation and sound		
The website allows me to interact with other users or content providers		
There is a sitemap and a search function that allows free text searches		
The website has a streamlined design that leaves a good first impression		
The content is reliable and is frequently updated		
The page layouts have column width and fonts that are easily read		
The website uses graphics to improve the understanding for the user		
It is possible to locate the website through a search engine		
The pages are in my native language		
I feel safe from virus and other security violations		
The website has focused content and there is not a lot of other content such as ads		

Previous page | Finish

Appendix 2 - Construction of model based data mining

Table A2.1 - Data mining findings on "Level 1"

Language = English

Age	Balanced	Content	Usability	Max	Output
16-25	0	1	4	4	Usability
26-35	3	13	29	29	Usability
46-55	0	3	13	13	Usability
56-65	1	3	1	3	Content
	Sum		**71**	**49**	
	Standard deviation		**9,0**		
	Rule reliability			**69,0%**	

Computer Usage	Balanced	Content	Usability	Max	Output
4-6 days a week	0	1	2	2	Usability
Every day	4	19	45	45	Usability
	Sum		**71**	**47**	
	Standard deviation		**17,8**		
	Rule reliability			**66,2%**	

Connection Speed	Balanced	Content	Usability	Max	Output
High speed	3	14	38	38	Usability
Low speed	0	5	7	7	Usability
Medium speed	1	1	2	2	Usability
	Sum		**71**	**47**	
	Standard deviation		**12,7**		
	Rule reliability			**66,2%**	

Region	Balanced	Content	Usability	Max	Output
Europe	0	2	5	5	Usability
North America	4	17	38	38	Usability
Other	0	1	4	4	Usability
	Sum		**71**	**47**	
	Standard deviation		**13,1**		
	Rule reliability			**66,2%**	

We note that an age rule is the most reliable and furthermore the only meaningful segmentation since all other rules would not add value since they do not segment into both content and usability.

Table A2.1 - Data mining findings on "Level 1" (continued)

Language = Non-English

Age	Balanced	Content	Usability	Max	Output
16-25	0	19	15	19	Content
26-35	13	85	68	85	Content
46-55	3	15	9	15	Content
56-65	0	2	0	2	Content
	Sum		**229**	**121**	
	Standard deviation		**29,7**		
	Rule reliability			**52,8%**	

Computer Usage	Balanced	Content	Usability	Max	Output
1-3 days a week	0	2	0	2	Content
4-6 days a week	2	6	3	6	Content
Every day	14	113	89	113	Content
	Sum		**229**	**121**	
	Standard deviation		**46,9**		
	Rule reliability			**52,8%**	

Connection Speed	Balanced	Content	Usability	Max	Output
High speed	11	98	73	98	Content
Low speed	0	10	3	10	Content
Medium speed	5	13	16	16	Usability
	Sum		**229**	**124**	
	Standard deviation		**36,3**		
	Rule reliability			**54,1%**	

Region	Balanced	Content	Usability	Max	Output
Europe	16	115	85	115	Content
Other	0	6	7	7	Usability
	Sum		**229**	**122**	
	Standard deviation		**47,9**		
	Rule reliability			**53,3%**	

We note that both connection speed and region has the potential for a rule, but since connection speed has the highest reliability it is selected.

Table A2.2 - Data mining findings on "Level 2"

Language = English, Age = 16-25

Computer Usage	Balanced	Content	Usability	Max	Output
Every day	0	1	4	4	Usability
	Sum		**5**	**4**	
	Standard deviation		**1,5**		
	Rule reliability			**80,0%**	

Connection Speed	Balanced	Content	Usability	Max	Output
High speed	0	1	4	4	Usability
	Sum		**5**	**4**	
	Standard deviation		**1,5**		
	Rule reliability			**80,0%**	

Region	Balanced	Content	Usability	Max	Output
North America	0	1	3	3	Usability
Other	0	0	1	1	Usability
	Sum		**5**	**4**	
	Standard deviation		**1,1**		
	Rule reliability			**80,0%**	

Dim1	Dim2	Dim3	Content	Usability
Every day	High speed	North America	1	3
Every day	High speed	Other	0	1

We note that the trail terminates here for this branch as neither the segments nor a combination of all segments lead to rules with both content and usability output.

Table A2.2 - Data mining findings on "Level 2" (continued)

Language = English, Age = 26-35

Computer Usage	Balanced	Content	Usability	Max	Output
4-6 days a week	0	0	1	1	Usability
Every day	3	13	28	28	Usability
	Sum		**45**	**29**	
	Standard deviation		**11,3**		
	Rule reliability			**64,4%**	

Connection Speed	Balanced	Content	Usability	Max	Output
High speed	2	11	24	24	Usability
Low speed	0	2	3	3	Usability
Medium speed	1	0	2	2	Usability
	Sum		**45**	**29**	
	Standard deviation		**8,4**		
	Rule reliability			**64,4%**	

Region	Balanced	Content	Usability	Max	Output
Europe	0	1	2	2	Usability
North America	3	11	24	24	Usability
Other	0	1	3	3	Usability
	Sum		**45**	**29**	
	Standard deviation		**8,3**		
	Rule reliability			**64,4%**	

Dim1	Dim2	Dim3	Content	Usability
4-6 days a week	High speed	North America	0	1
Every day	High speed	Europe	0	1
Every day	High speed	North America	11	20
Every day	High speed	Other	0	2
Every day	Low speed	Europe	1	0
Every day	Low speed	North America	0	2
Every day	Low speed	Other	1	1
Every day	Medium speed	Europe	0	1
Every day	Medium speed	North America	0	1

We note that we identify two additional rules in depth of this branch through the combination of all remaining segments. Since there are no mining options left for this branch, further searching is terminated on this branch.

Table A2.2 - Data mining findings on "Level 2" (continued)

Language = English, Age = 46-55

Computer Usage	Balanced	Content	Usability	Max	Output
4-6 days a week	0	1	1	1	Usability
Every day	0	2	12	12	Usability
	Sum		**16**	**13**	
	Standard deviation		**4,6**		
	Rule reliability			**81,3%**	

Connection Speed	Balanced	Content	Usability	Max	Output
High speed	0	1	10	10	Usability
Low speed	0	1	3	3	Usability
Medium speed	0	1	0	1	Content
	Sum		**16**	**14**	
	Standard deviation		**3,4**		
	Rule reliability			**87,5%**	

Region	Balanced	Content	Usability	Max	Output
Europe	0	1	2	2	Usability
North America	0	2	11	11	Usability
	Sum		**16**	**13**	
	Standard deviation		**4,1**		
	Rule reliability			**81,3%**	

We identify one rule based on connection speed. The blue color is used to identify rules that are not conclusive since they are based on a balance between content and usability. In the most complex rule set in table 20 and figure 15, we will exclude these areas that we know are uncertain to optimize the reliability of the model overall.

Table A2.2 - Data mining findings on "Level 2" (continued)

Language = English, Age = 56-65

Computer Usage	Balanced	Content	Usability	Max	Output
Every day	1	3	1	3	Content
	Sum		**5**	**3**	
	Standard deviation		**1,0**		
	Rule reliability			**60,0%**	

Connection Speed	Balanced	Content	Usability	Max	Output
High speed	1	1	0	1	Content
Low speed	0	2	1	2	Content
	Sum		**5**	**3**	
	Standard deviation		**0,7**		
	Rule reliability			**60,0%**	

Region	Balanced	Content	Usability	Max	Output
Europe	0	0	1	1	Usability
North America	1	3	0	3	Content
	Sum		**5**	**4**	
	Standard deviation		**1,2**		
	Rule reliability			**80,0%**	

We identify a region rule on this branch.

Table A2.2 - Data mining findings on "Level 2" (continued)

Language = Non-English, Connection Speed = High speed

Age	Balanced	Content	Usability	Max	Output
16-25	0	15	13	15	Content
26-35	9	72	54	72	Content
46-55	2	10	6	10	Content
56-65	0	1	0	1	Content
	Sum		**182**	**98**	
	Standard deviation		**24,9**		
	Rule reliability			**53,8%**	

Computer Usage	Balanced	Content	Usability	Max	Output
1-3 days a week	0	1	0	1	Content
4-6 days a week	2	3	2	3	Content
Every day	9	94	71	94	Content
	Sum		**182**	**98**	
	Standard deviation		**38,8**		
	Rule reliability			**53,8%**	

Region	Balanced	Content	Usability	Max	Output
Europe	11	94	68	94	Content
Other	0	4	5	5	Usability
	Sum		**182**	**99**	
	Standard deviation		**39,3**		
	Rule reliability			**54,4%**	

We identify a region rule on this branch.

Table A2.2 - Data mining findings on "Level 2" (continued)

Language = Non-English, Connection Speed = Low speed

Age	Balanced	Content	Usability	Max	Output
16-25	0	1	1	1	Content
26-35	0	7	1	7	Content
46-55	0	1	1	1	Content
56-65	0	1	0	1	Content
	Sum		**13**	**10**	
	Standard deviation		**2,1**		
	Rule reliability			**76,9%**	

Computer Usage	Balanced	Content	Usability	Max	Output
4-6 days a week	0	1	0	1	Content
Every day	0	9	3	9	Content
	Sum		**13**	**10**	
	Standard deviation		**3,5**		
	Rule reliability			**76,9%**	

Region	Balanced	Content	Usability	Max	Output
Europe	0	9	3	9	Content
Other	0	1	0	1	Content
	Sum		**13**	**10**	
	Standard deviation		**3,5**		
	Rule reliability			**76,9%**	

Dim1	Dim2	Dim3	Content	Usability
16-25	Every day	Europe	1	1
26-35	4-6 days a week	Europe	1	0
26-35	Every day	Europe	6	1
46-55	Every day	Europe	1	1
56-65	Every day	Other	1	0

We note that the branch ends with two rules where there is a balance between content and usability. In the most complex rule set in table 20 and figure 15, we will exclude these areas that we know are uncertain to optimize the reliability of the model overall.

Additionally, we note the power of finalizing a branch with the matrix; as in this case one rule "" would have been neglected.

Table A2.2 - Data mining findings on "Level 2" (continued)

Language = Non-English, Connection Speed = Medium speed

Age	Balanced	Content	Usability	Max	Output
16-25	0	3	1	3	Content
26-35	4	6	13	13	Usability
46-55	1	4	2	4	Content
	Sum		**34**	**20**	
	Standard deviation		**4,0**		
	Rule reliability			**58,8%**	

Computer Usage	Balanced	Content	Usability	Max	Output
1-3 days a week	0	1	0	1	Content
4-6 days a week	0	2	1	2	Content
Every day	5	10	15	15	Usability
	Sum		**34**	**18**	
	Standard deviation		**5,6**		
	Rule reliability			**52,9%**	

Region	Balanced	Content	Usability	Max	Output
Europe	5	12	14	14	Usability
Other	0	1	2	2	Usability
	Sum		**34**	**16**	
	Standard deviation		**5,8**		
	Rule reliability			**47,1%**	

We select the "age rule" for next branch.

Table A2.3 - Data mining findings on "Level 3"

Language = English, Age = 46-55, Connection Speed = High speed

Computer Usage	Balanced	Content	Usability	Max	Output
4-6 days a week	0	1	1	1	Usability
Every day	0	0	9	9	Usability
	Sum		**11**	**10**	
	Standard deviation		**3,6**		
	Rule reliability			**90,9%**	

Region	Balanced	Content	Usability	Max	Output
Europe	0	0	2	2	Usability
North America	0	1	8	8	Usability
	Sum		**11**	**10**	
	Standard deviation		**3,1**		
	Rule reliability			**90,9%**	

Dim1	Dim2	Content	Usability
4-6 days a week	North America	1	1
Every day	Europe	0	2
Every day	North America	0	7

We note that the branch ends and the matrix did not contribute more to the findings.

Language = English, Age = 46-55, Connection Speed = Low speed

Computer Usage	Balanced	Content	Usability	Max	Output
Every day	0	1	3	3	Usability
	Sum		**4**	**3**	
	Standard deviation		**1,0**		
	Rule reliability			**75,0%**	

Region	Balanced	Content	Usability	Max	Output
North America	0	1	3	3	Usability
	Sum		**4**	**3**	
	Standard deviation		**1,0**		
	Rule reliability			**75,0%**	

We not the branch ends, and since there are only one segmentation on both segments, the matrix will not add any additional information.

Table A2.3 - Data mining findings on "Level 3" (continued)

Language = English, Age = 46-55, Connection Speed = Medium speed

Computer Usage	Balanced	Content	Usability	Max	Output
Every day	0	1	0	1	Content
	Sum		**1**	**1**	
	Standard deviation		**0,5**		
	Rule reliability			**100,0%**	

Region	Balanced	Content	Usability	Max	Output
Europe	0	1	0	1	Content
	Sum		**1**	**1**	
	Standard deviation		**0,5**		
	Rule reliability			**100,0%**	

We note the branch ends, and a matrix will not add any additional information since there is only one participant in the segment.

Language = English, Age = 56-65, Region = Europe

Computer Usage	Balanced	Content	Usability	Max	Output
Every day	0	0	1	1	Usability
	Sum		**1**	**1**	
	Standard deviation		**0,5**		
	Rule reliability			**100,0%**	

Connection Speed	Balanced	Content	Usability	Max	Output
Low speed	0	0	1	1	Usability
	Sum		**1**	**1**	
	Standard deviation		**0,5**		
	Rule reliability			**100,0%**	

We note the branch ends, and a matrix will not add any additional information since there is only one participant in the segment.

Table A2.3 - Data mining findings on "Level 3" (continued)

Language = English, Age = 56-65, Region = North America

Computer Usage	Balanced	Content	Usability	Max	Output
Every day	1	3	0	3	Content
	Sum		**4**	**3**	
	Standard deviation		**1,5**		
	Rule reliability			**75,0%**	

Connection Speed	Balanced	Content	Usability	Max	Output
High speed	1	1	0	1	Content
Low speed	0	2	0	2	Content
	Sum		**4**	**3**	
	Standard deviation		**0,8**		
	Rule reliability			**75,0%**	

We note the branch ends, and since there is only one participant in the balanced insecure segmentation, no additional information can be derived from the matrix.

Language = Non-English, Connection Speed = High speed, Region = Europe

Age	Balanced	Content	Usability	Max	Output
16-25	0	14	13	14	Content
26-35	9	70	49	70	Content
46-55	2	9	6	9	Content
56-65	0	1	0	1	Content
	Sum		**173**	**94**	
	Standard deviation		**23,7**		
	Rule reliability			**54,3%**	

Computer Usage	Balanced	Content	Usability	Max	Output
1-3 days a week	0	1	0	1	Content
4-6 days a week	2	3	2	3	Content
Every day	9	90	66	90	Content
	Sum		**173**	**94**	
	Standard deviation		**36,7**		
	Rule reliability			**54,3%**	

Dim1	Dim2	Content	Usability
16-25	4-6 days a week	1,00	0,00
16-25	Every day	13,00	13,00
26-35	1-3 days a week	1,00	0,00
26-35	4-6 days a week	2,00	2,00
26-35	Every day	67,00	47,00
46-55	Every day	9,00	6,00
56-65	Every day	1,00	0,00

We note the branch ends and the power of the matrix to find information hidden.

Table A2.3 - Data mining findings on "Level 3" (continued)

Language = Non-English, Connection Speed = High speed, Region = Other

Age	Balanced	Content	Usability	Max	Output
16-25	0	1	0	1	Content
26-35	0	2	5	5	Usability
46-55	0	1	0	1	Content
	Sum		**9**	**7**	
	Standard deviation		**1,7**		
	Rule reliability			**77,8%**	

Computer Usage	Balanced	Content	Usability	Max	Output
Every day	0	4	5	5	Usability
	Sum		**9**	**5**	
	Standard deviation		**0,5**		
	Rule reliability			**55,6%**	

We can add the "age rule" to the branch without further analysis, since there are no more segments that have more than one member.

Language = Non-English, Connection Speed = Medium speed, Age = 16-25

Computer Usage	Balanced	Content	Usability	Max	Output
4-6 days a week	0	2	0	2	Content
Every day	0	1	1	1	Content
	Sum		**4**	**3**	
	Standard deviation		**0,7**		
	Rule reliability			**75,0%**	

Region	Balanced	Content	Usability	Max	Output
Europe	0	3	0	3	Content
Other	0	0	1	1	Usability
	Sum		**4**	**4**	
	Standard deviation		**1,2**		
	Rule reliability			**100,0%**	

We note that by selecting region as rule, we select with 100% accuracy between content and usability so this branch ends with region.

Table A2.3 - Data mining findings on "Level 3" (continued)

Language = Non-English, Connection Speed = Medium speed, Age = 26-35

Computer Usage	Balanced	Content	Usability	Max	Output
1-3 days a week	0	1	0	1	Content
4-6 days a week	0	0	1	1	Usability
Every day	4	5	12	12	Usability
Sum			**23**	**14**	
Standard deviation			**4,3**		
Rule reliability				**60,9%**	

Region	Balanced	Content	Usability	Max	Output
Europe	4	6	12	12	Usability
Other	0	0	1	1	Usability
Sum			**23**	**13**	
Standard deviation			**4,8**		
Rule reliability				**56,5%**	

Dim1	Dim2	Content	Usability
1-3 days a week	Europe	1,00	0,00
4-6 days a week	Europe	0,00	1,00
Every day	Europe	5,00	11,00
Every day	Other	0,00	1,00

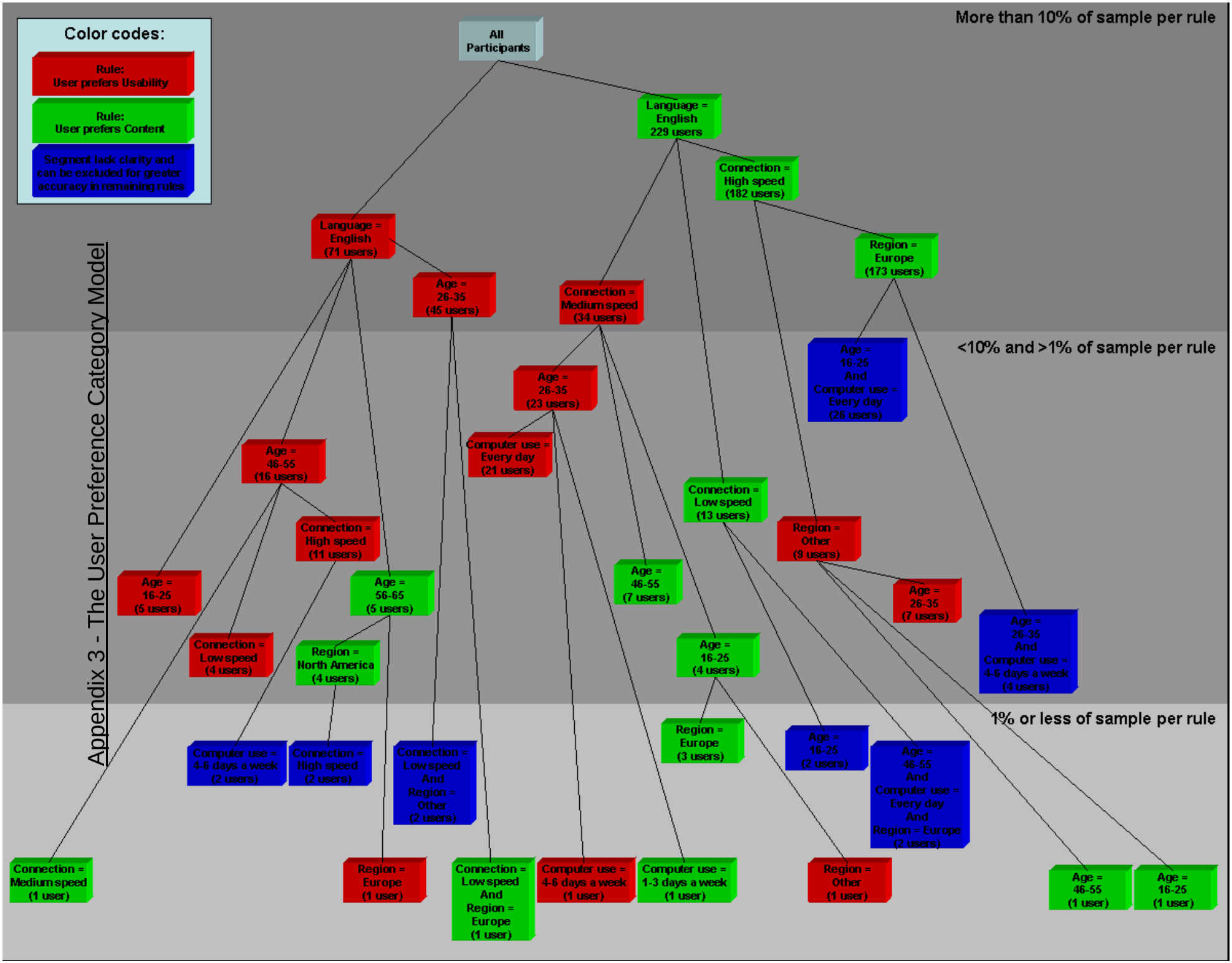
We note that we can terminate the branch with computer usage, as the matrix did not uncover any additional deeper rules.

Language = Non-English, Connection Speed = Medium speed, Age = 46-55

Computer Usage	Balanced	Content	Usability	Max	Output
Every day	1	4	2	4	Content
Sum			**7**	**4**	
Standard deviation			**1,0**		
Rule reliability				**57,1%**	

Region	Balanced	Content	Usability	Max	Output
Europe	1	3	2	3	Content
Other	0	1	0	1	Content
Sum			**7**	**4**	
Standard deviation			**1,1**		
Rule reliability				**57,1%**	

We note the branch ends here.


Color codes:
Rule: User prefers Usability
Rule: User prefers Content
Segment lack clarity and can be excluded for greater accuracy in remaining rules
Appendix 3 - The User Preference Category Model
More than 10% of sample per rule
<10% and >1% of sample per rule
1% or less of sample per rule
All Participants
Language = English 229 users
Language = English (71 users)
Connection = High speed (182 users)
Region = Europe (173 users)
Age = 26-35 (45 users)
Connection = Medium speed (34 users)
Age = 16-25 And Computer use = Every day (26 users)
Age = 26-35 (23 users)
Computer use = Every day (21 users)
Age = 46-55 (16 users)
Connection = Low speed (13 users)
Region = Other (9 users)
Connection = High speed (11 users)
Age = 46-55 (7 users)
Age = 16-25 (5 users)
Age = 56-65 (5 users)
Age = 26-35 (7 users)
Age = 26-35 And Computer use = 4-6 days a week (4 users)
Connection = Low speed (4 users)
Region = North America (4 users)
Age = 16-25 (4 users)
Region = Europe (3 users)
Age = 16-25 (2 users)
Age = 46-55 And Computer use = Every day And Region = Europe (2 users)
Computer use = 4-6 days a week (2 users)
Connection = High speed (2 users)
Connection = Low speed And Region = Other (2 users)
Connection = Medium speed (1 user)
Region = Europe (1 user)
Connection = Low speed And Region = Europe (1 user)
Computer use = 4-6 days a week (1 user)
Computer use = 1-3 days a week (1 user)
Region = Other (1 user)
Age = 46-55 (1 user)
Age = 16-25 (1 user)

Bibliography

Books

Cooper, Donald R, Schindler, Pamela S, Business Research Methods 7th Edition, New York, NY, McGraw-Hill, 2001.

Fleming, Jennifer, Web Navigation: Designing the User Experience, Sebastanopol, CA, O'Reilly Associates Inc, 1998.

Green, Paul E, Tull, Donald S, Albaum, Gerald, Researching for Marketing Decisions 5th Edition, Englewood Cliffs, NJ, Prentice-Hall, 1988.

Nielsen, Jakob, Designing Web Usability: The Practice of Simplicity, Indianapolis, IN, New Riders Publishing, 2000.

Articles and Web content

CIA - The World Fact Book 2001,
Website: http://www.odci.gov/cia/publications/factbook/

Glowa, Tim, Lawson, Sean, Discrete choice experiments and traditional conjoint analysis, May 2000, North Country Research Inc. Website: http://www.glowa.ca/

Middelfart, Morten, Jakob Nielsen - The Guru of Web Usability, May 2002,
Website: www.morton.dk

Nielsen, Jakob, Past Presentations by Jakob Nielsen, 16th May 2002
Website: www.useit.com

Robinson, Patrick J, Population Sampling Issues and Reminders, Research Update #85, June 1995, Robinson Consulting Inc,
Website: http://www.synergicconsulting.com/