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# **Designing visualisations containing search engine results for novices**

A search for heuristics

Master's thesis in Applied Information Technology

SIMON OLSSON



MASTER'S THESIS 2015:127

# Designing visualisations containing search engine results for novices

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CHALMERS UNIVERSITY OF TECHNOLOGY  
Gothenburg, Sweden 2015

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## Abstract

Designing SEO visualisations and furthermore for novices is a small research area. Not much has been done considering this subject concerning thorough research. The thesis aims to increase knowledge in this area. Furthermore, it is in the interest of the thesis to create a tool which will make SEO data more accessible to novices and that can aid in their seeking of information regarding this area.

Several prototypes and design iterations are conducted in order to create a combination of visualisations and representations that will result in the proposed tool. The thesis proposes a design suitable for presenting SEO data to novices. Furthermore, heuristics are discerned and explored in order to establish a set of guidelines concerning core values permeating SEO visualisations aimed at novices. Furthermore, a user study is conducted that suggests the validity of the final design and the proposed heuristics.

**Keywords:** SEO, information visualisation, novices, usability, interaction design, heuristics



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Simon Olsson, Gothenburg, May 2015



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# 1

## Introduction

*"The soul should always stand ajar, ready to welcome the ecstatic experience."*

- Emily Dickinson

My interest in search engine optimisation (SEO) and its many facets arose during the fall of 2014 while working at SEO Design AB. As a novice in the field I was immediately captivated by the SEO technicians work and the many tools and techniques they use in order to make a website rank higher on search engines such as Google. Although I was interested I found it difficult to understand the many visualisations and tools that were used because they were generally targeted towards people already familiar with SEO. Graphs and charts were often cluttered with data and the tables containing keyword data seemed endless. For an expert with knowledge in the field this approach seemed to work although after discussions with technicians notions of visualisations being either superfluous, unnecessary or complicated also rose to the surface. Thus, the idea of designing visualisations that would increase efficiency and be catered toward the novice emerged.

For a customer of an SEO firm it is in their interest to get an insight into how their SEO efforts are developing but the current methods are either too shallow or too complicated. Thus, researching how novices interpret data regarding SEO and creating visualisations that would complement their own internal mental models piqued my interest.

The aim of this thesis is then to research how novices interpret search engine results data and how design and visualisations can be used in order to augment their cognitive process. The resulting design should be backed up by empirical data that shows that the design is indeed efficient. Also, heuristics which permeate the design should be established and explored.

### 1.1 Describing the problem area

The problem when it comes to these types of tools (in this case SEO tools) and complicated sets of data is that there is a skew towards them being meant more for experts rather than novices. Thus, when introducing an, in some ways, unqualified

audience the difficulty arises when attempting to cater the design towards this new user group.

Websites are becoming more and more of a necessity for all types of businesses. A company's website is its face presented to the outside world and thus ranking high on search engines is vital in today's busy online world. Companies often turn to SEO firms who are experts in this field in hope that they can help them to become more visible on the web. This is the incentive these companies have. With the presented tool they would be able to get access to data showing them how they are ranking, how their ranking has been historically and what might be factors to why certain search words aren't working as well as they intended. In order to give these companies a quick overview and simple tools to achieve their goals within the system is key. Thus, presenting the data in a way that suits the user group and providing suitable tools is the problem at hand that will be explored through out this thesis.

## 1.2 Raising the research question

In order to design for novices one must consider many factors and a general solution will almost certainly not suit all members. This thesis aims to analyse one perspective of heuristics regarding designing SEO visualisations for novices. In order to answer this question two separate investigations will be explored in the thesis - 1) Is there a set of heuristics that can aid in the design of SEO visualisations for novices? 2) What qualities would such a system hold and what are its benefits?

Such inquiries require an empirical study in order to be answered. Heuristics are hard to define in an area as vague as design and they are even harder to motivate since there are a great number of opinions. Thus, one could argue that the issue of developing heuristics in such an environment and examining the qualities of them is a wicked problem [33]. Nonetheless, such heuristics are useful to examine and this thesis aims to propose a set of heuristics that can be used when designing similar systems.

## 1.3 Defining the research scope

The presented thesis' aim is to create a set of heuristics involved when executing ones design work and is thus meant exclusively for practitioners, researchers and teachers of design. Particularly those involved in the fields of interaction design and information visualisation. The thesis explores concepts, presents examples and discusses theories related to the research question of this thesis. Due to the great deal of information and examples available it is the thesis' intent to focus solely on those already involved or have knowledge of the works in the fields of information visualisation and interaction design. Also, because of the temporal aspects of this project, catering to experts is one part of the research scope. Other limitations

involve focusing on presenting useful tools and examples in order to tackle designing SEO visualisations for novices. This has resulted in a scope which can be divided in two. This scope is presented in the list below.

1. Angling this thesis towards designers allows for more detailed and focused design examples. Also, designers are more familiar with other aspects of information visualisation and interaction thus many concepts regarding this research will be familiar and allow for more easily understanding new ones.
2. Presenting detailed and precise examples will allow for better motivating the heuristics which are to be explored in this thesis. Well designed examples allow for a good basis for understanding, which is the goal of this thesis.

This scope will allow the thesis to present its findings in a well defined manner and simultaneously cater to a large audience of designers working in various fields within interaction design and information visualisation.

## 1.4 Outlining the thesis

In the Introduction (Chapter 1) the thesis is introduced and described. Next, the problem area is defined and a discussion of what the problem at hand is and why it is a problem is brought up. Furthermore, the research problem is divided into two parts where defining a set of heuristics is the first and examining their qualities and the benefits of these heuristics. Afterwards the research scope is brought to light and the two major limitations of the thesis are identified as the thesis being aimed for designers and also the focus on detailed examples. Lastly, the outline of this thesis is presented.

The following chapter contains the Background (Chapter 2) of the thesis. Here information about search engine optimisation is presented due to it being the focus of the system discussed throughout this thesis. Lastly, related work is examined and discussed in order to see examples of working examples and examine how they work.

The Theory chapter (Chapter 3) contains concepts and theories related to the work conducted in this thesis. The thesis is placed into the context of information visualisation and related research is discussed in order to gain insight into relevant adjacent fields of information visualisation and interaction design.

Continuing onward, the Methodology chapter (Chapter 4) defines the design framework used throughout this thesis as User Centred Design (UCD). The implications and significance of this choice is discussed in detail. Furthermore, the individual methods used are also presented. Explanations combined with reasoning validates the choice of these methods.

In the following chapter, Planning (Chapter 5) the temporal scope and plan of execution is both explained and illustrated.

The Design chapter (Chapter 6) describes the development process of the prototyping and design iterations. Requirements are set down and iterations are executed in order to reach these requirements. Furthermore, interactions are added to the design in order to augment it with further details. Lastly, the design is briefly evaluated.

The next chapter (Chapter 7) contains the user study used to add validity to the design. Test subjects are presented with tasks which are measured in time, amount of errors and a rating of user experience. This data is later analysed, summarised and used to evaluate the design and its efficiency.

The following chapter (Chapter 8) describes the process of developing heuristics. The design is used to discern individual heuristics and the user study is used to validate these heuristics.

The Results chapter (Chapter 9) contains a brief summary of the final design, results from the user study and the discerned heuristics.

In the Discussion (Chapter 10) major parts of this thesis is discussed. The method, results, generalisability, ethical issues and future work is discussed.

Lastly, the Conclusion (Chapter 11) presents final thoughts of this thesis work and its outcome.

# 2

## Background

*"Either I will find a way, or I will make one."*

- Philip Sidney

Search Engine Optimisation (SEO) is a complex area. There are an infamous amount of factors that influence the outcome. Also, there are equally as many ways of achieving good results (high page rankings). One thing that is certain is that this field is becoming more and more complex as more websites are being developed, along with new technologies and the search engine algorithms are being developed further. The most famous of these algorithms is Google's. Google is constantly updating, tweaking and revising their algorithm and thus SEO firms must always be on their toes and up to date in order to achieve the best results.

### 2.1 SEO Design AB

SEO Design AB is a digital agency specialising in SEO, adWords, remarketing and web development. They have a thirteen year long history of working within these fields and have developed comprehensive knowledge in these areas. In order to produce good results for their customers within the field of SEO they rely first on the skill of their SEO technicians but also on several tools aiding the process of acquiring and displaying SEO data. It is in SEO Design AB's interest to develop a tailored tool of their own which will be added to their list of SEO tools. Furthermore, it is in SEO Design AB's interest to create this tool to visualise SEO data to its customers. These customers are novices in the field of SEO and therefore the resulting design must be catered to this target group.

### 2.2 SEO

SEO can be summarised as the act of increasing traffic to a website. This can be done using various methods, both internal to the website and external ones. Internal methods include actions such as updating content, adding keywords and

descriptions, increasing page speed and adding responsive design. External methods involve, among other, adding backlinks to the website from other websites. By combining these methods one can increase the search engine ranking and traffic to ones website.

There are many search engines as of today but the major one is Google's. With a market share of 64.4 % as of January 2015 it is the dominant actor of its market [26]. Thus it is this search engine that is most important to rank well on and it will be the focus of this thesis.

### 2.2.1 Using Google's search engine

Let us begin this section by exploring the internals of Google's search engine and how it works. Google's search engine is based on four key mechanisms [13]. These are listed below.

**Discovery** of websites.

**Storage** of links, page summaries and other information.

**Ranking** the pages based on how relevant they are to the search query.

**Return** the results to the user.

The step concerning Discovery is the one that the person executing SEO has control over. The internals of Google is not something one can affect when doing SEO work. There are, however, a few practices to follow; set a topic, define your target audience, create good content, keyword generation, create pages, create a community, build links [14]. Set a topic and Define your target audience in order to focus your efforts when Creating good content. Using Keyword Generation in order to find effective keywords for you to use when optimising the SEO on your website is key. Create Pages because Google does not rank websites, it ranks pages. Creating a Community on your website such as a blog can help keep content fresh and drive traffic to your website. A substantial part of Google's ranking algorithm consists of the amount and quality of links that link to your website. Thus, Building Links to your website is a vital part in the SEO work.

### 2.2.2 SERP

SERP stands for Search Engine Results Page, which is the results a search engine presents when given a keyword query. The result generally consists of a position, page, title, link and description. There is no standard wich has been agreed upon thus each search engine can return a different set of SERP data for a given query. However, usually a set of ten listings is displayed on each page. The value of being listed as early as possible in the SERP is extensive. A study shows that the Click

Through Rate (CTR), the number of people that click on a link, of being on the first page of the SERP results is 32.5 %. The second page only has a CTR of 17.6 %, almost half of being on the front page [20]. After the third page the CTR's get below two digits and become more and more insignificant. Thus, when considering effectiveness of listings achieving a high rank on the SERP is vital.

There are two types of SERP data and those are organic and paid. Organic listings are the ones the search engine has found through its algorithms and the paid listings are, as the name implies, listings that have been paid to get a high rank. The organic listings are the ones that can be affected by SEO work using various techniques.

### 2.2.3 Keywords

In order to achieve high rankings a website can focus on certain keywords in an attempt to optimise against them. SEO Design AB uses two types of keywords, Primary and Overwatch. The primary keywords are the keywords which will be optimised against and the overwatch keywords are ones which will be kept under surveillance. Thus, overwatch keywords receive no optimisation but are simply there in order to get an overview of how they are developing. This is an important difference as the primary keywords are the ones the customer will be paying for and the overwatch keywords will be chosen entirely by SEO Design AB, thus not having any effect on either the optimisation or the customer's check book.

### 2.2.4 Backlinks

All incoming links to a website or domain are called backlinks [24]. The amount of backlinks a website has is a measure of its popularity and thus it can be used as a SEO measurement. If a website has a large amount of incoming links it would increase Google's page ranking of said website. As stated by Google: 'Google interprets a link from page A to page B as a vote by page A for page B. Votes cast by pages that are themselves "important" weigh more heavily and help to make other pages "important"' [25]. Thus, to have knowledge of the amount and quality of a website's backlinks is important in understanding why your website might be ranking poorly or well.

## 2.3 Related work

In this area where data is key it is important to be able to access data and manipulate it. Hence there are many tools which give users, and among them, SEO firms this ability. Tools such as Wincher, Google Webmaster Tools, SEOprofiler and SERPLab all gather data and allow users to use it in order to get information about their own sites or customers. In the following sections a few of the aforementioned tools will be highlighted.

### 2.3.1 Wincher

Wincher<sup>1</sup> is a very popular tool in the SEO community due to its simplicity. Key features are:

1. Graphs and visualisations of keyword rankings and their history.
2. Plan reports to be sent out at certain intervals.
3. See data on total amount of searches for keywords.
4. Automatic alerts when keywords go up or down.

A lot of this data is general throughout the tools but Wincher does a great job of presenting this data to the user. The graphs and visualisations are easy to understand and manipulate and the user interface makes navigation easy.

### 2.3.2 Google Webmaster Tools

Webmaster Tools<sup>2</sup> is Google's own response to the SEO market. It allows users to:

1. Identify problems Google has found with your website.
2. Gives you information about what users are visiting your site.
3. Optimise your website so Google can more easily interpret it.

This tool focuses on making your site more Google-friendly and thus allowing you to rank higher. It also allows to track what type of users visit your site and thus providing information that can help you make decisions that will improve your website and market it towards the people that visit it.

### 2.3.3 SEProfiler

SEProfiler<sup>3</sup> is a comprehensive SEO-suite that lets the user find and see a large array of data regarding SEO of their websites. Among others it provides:

1. Site optimisation tools.
2. Keyword research.

---

<sup>1</sup><https://www.winner.com>

<sup>2</sup><https://www.google.com/webmasters/tools/home?hl=en>

<sup>3</sup><http://www.seoprofiler.com>

3. Competition analysis.
4. Link management.
5. Various reports on your site's status.

By providing a comprehensive suite SEOprofiler is a great tool for experts to use in their work. It provides almost all tools an SEO technician would need in their daily tasks. Although, it is a great tool, it is not aimed at novices. The tool requires a user that is well versed in the world of SEO to make sense of the tools and data presented.

### **2.4 Benefits of an internal system**

As a SEO firm being able to control the type and flow of data is a substantial upside. Using external systems such as the aforementioned provide useful tools and data but the user has no control over how those tools operate or what types of data they produce. Having an internal system over which one has full control and ownership of provides the option for change and how the system will work. Also, the proposed system holds features from many of the other mentioned tools in a combination that suits the work of the technicians that work there.

Having the opportunity to have a tailored system over which there is complete ownership is a vital key in the SEO firm's ability to provide good and consistent work for its customers. Furthermore, being able to create custom tools that the firm's competitors do not have readily available is a great advantage.

Migrating from the use of external tools to an internal system allows for the creation of a base on which a platform can be built. This platform can then house many separate tools and integrations that can be tailored to the specific work of the technicians. Lastly, this platform can be influenced by the plethora of tools already used by the technicians but can be customised to suit the technicians needs.

# 3

## Theory

*"We cannot solve our problems with the same thinking we used when we created them."*

- Albert Einstein

This thesis encompasses several related concepts and subjects. Concepts such as information visualisation, interaction design and usability will be discussed and explored. These subjects will be considered as the theoretical framework on which this thesis will lay its own weight. Also, parallels will be drawn to the subjects layed out in this chapter in order to deepen the relationship between design examples and underlying theoretical concepts.

### 3.1 Information visualisation

The main focus of this thesis lies in the field of information visualisation and thus a large body of the research conducted in that area falls inside the scope of this thesis. In this section information visualisation and its facets will be explored.

Ware defines four stages that are involved in information visualisation [1], these are briefly summarised below.

1. The collection of data.
2. Process and manipulate the data.
3. Making the data visual.
4. Human perception.

These four stages sum up the visualisation of information from gathering data to presenting something on the screen that a human can perceive. Ware identifies the critical step as the data manipulation phase were the goal is to create a visualisation that humans can ultimately understand and use for decision making [1]. This

information visualisation process is a key element in this thesis. The continuous realisation that data must ultimately be displayed and made sense to humans directs the data and its manipulation in order for it to end up in a way that a humans will understand.

Ware also discusses the difference among various visual languages and the prior knowledge necessary to understand them. A cave painting and a mathematic equation are both examples of visual language but require entirely different skill sets in order to interpret [1]. The fact that some visualisations may require years of training to understand and make use of (e.g. reading and writing) must ultimately guide the design of visualisations to suit the intended audience.

### 3.1.1 Perception and Benefits

Visualising information is converting raw data and presenting it in an efficient manner. Thus it is important to understand how the visualisations should be produced to increase the chance of maximum perception for the user. This requires knowledge in how humans perceive visualisations and what types of conclusions can be drawn from them. Kerren brings up an example where a spreadsheet is compared to a scatterplot containing the same set of information. Correlations between the data points and outliers is much easier to perceive in the graph versus the spreadsheet containing the same data [18]. Kerren also notes that the spreadsheet is itself a graphical representation of the data but for the given task it is a poor one and querying the data is highly complex due to the nature of the representation. Thus, using an efficient representation is crucial in information visualisation. One representation might be useful with certain types of data but poor for others.

The graphical representation of the data can be regarded as an external cognitive aid which augments the human memory and increases the working area [18]. Thus, visualising information can be seen as reducing the load on the human when he or she is to draw conclusions and work with data. Based on this one can see the need for the visualisation to be angled toward this purpose, aiding the human and reducing their cognitive load.

Reducing the cognitive load and increasing the effectiveness is the purpose when designing visualisations. Card et. al. have developed a set of guidelines [19] to aid in this process.

1. Increasing memory and processing resources available.
2. Reducing search for information.
3. Enhancing the recognition of patterns.
4. Enabling perceptual inference operations.
5. Using perceptual attention mechanisms for monitoring.

#### 6. Encoding info in a manipulable medium.

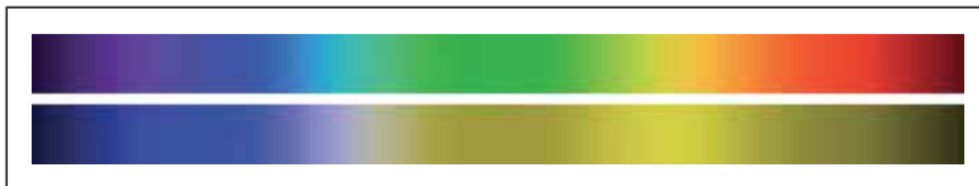
There are many facets to good information visualisation as seen from the above points. Using mechanisms, design and interactions to reduce the load on the human cognitive load are key factors and will be a red thread throughout this thesis.

### 3.1.2 Visualisation facets

There is much to consider when visualising anything in an efficient and well thought out manner. In order to cater to a large audience and to present efficient visualisations many facets of information visualisation must be explored and considered. There is, among others, coloring, various representations, cognitive ability and various principles related to how humans perceive the world. To consider all aspects is a daunting task but depending on the visualisation certain elements become more vital. In the following sections some visualisation facets will be explored and discussed in order to get a better handle on information visualisation and its many aspects.

#### Colors

A world without color is inconceivable to many but it is the reality of a significant portion of humanity. Thus, using colors in such a way that it can cater to a large partition of society as possible is ideal. Color blindness is in itself multi-faceted. There are many variations that result in various optical deficiencies. Deuteranopia or Red-Green color blindness is by far the most common and it is present in about 8 % of the male population [21].



**Figure 3.1:** Normal vision compared to red-green visual impairment.

As seen in figure 3.1 [21] the difference between the red and green spectrum is visible to people with normal vision but for someone with red-green visual impairment it is not so visible. Thus, it is important to consider alternatives that would suit both normal and impaired vision. An effective technique is utilising patterns in combination with coloring [21]. This provides another way of distinguishing the different parts of the visualisation and presents the user with more possibilities of understanding the graphic.

#### Representations

Various representations are part of our daily lives, for example words and numbers. These are both examples of arbitrary representations. These representations are hard to learn, easy to forget, embedded in culture and applications and are formally

powerful. It takes a human years to master the skills of writing, reading and using numbers but once learned they provide powerful tools we can use to fulfill various complicated tasks. The other type of representation is Sensory. Sensory representations are defined by: understanding without training, resistance to instructional bias, sensory immediacy, cross-cultural validity. These representations are ingrained in us and are symbols that are valid through all cultures [1].

Understanding how various representations are interpreted by humans is important when designing visualisations. Using representations that fit the context and provide meaning is key to providing efficient visualisations.

### **Cognitive ability**

Another important facet when it comes to visualisations is the amount of information a human can hold in memory at any given moment. Miller, in the seminal paper 'The Magical Number Seven', presents a term he calls the 'span of absolute judgement'. This span is the amount of elements a human can hold in attention at any given moment and that this amount is seven with a variance of two [22]. Thus, resulting in seven plus minus two.

Accepting that a human has limited cognitive abilities and that we only can hold a finite amount of elements in our attention span aids in the design process. The designer can use this information and create visualisations that instead of cluttering the mind with information augments the mind and allows for greater cognitive capacity.

The age old saying 'quality before quantity' is true in this case. The quality of the information presented to the user is often far more vital than the quantity. Designing good visualisations with well developed elements that are relevant to the work task is a key focus of this thesis.

### **Principles**

A famous set of principles used in information visualisation are the Gestalt principles. These principles were developed by German psychologists during the 1920's in an effort to decode human perception. Below is a list of the Gestalt principles [23] considered in this thesis.

**The Law of Simplicity** Every stimulus pattern is seen in such a way that the resulting structure is as simple as possible.

**The Law of Proximity** The perception of close elements as belonging together and/or as a whole.

**The Law of Similarity** The grouping of similar objects.

**The Law of Connectedness** Connected elements through lines (or similar) makes a stronger connection than size, shape, color or proximity.

These principles are easy to understand but they provide powerful tools that if abided by can aid the user in understanding a certain piece of design. By placing

related or similar objects in close proximity the designer can predict the perception of the user. As there is much known about the human condition and how we as humans perceive the world a designer can use this knowledge and create designs that are naturally understandable.

## 3.2 Interaction design

There are many definitions of interaction design and its meaning. Below are three definitions which will be discussed, among various other aspects of interaction design.

**Sharp et. al.** "Designing interactive products to support the way people communicate and interact in their everyday and working lives" [27].

**Cooper et. al.** "The practice of designing interactive digital products, environments, systems, and services" [28].

**Moggridge** "The design of everything that is both digital and interactive" [29].

These definitions vary greatly as there is no consensus on what interaction design truly means. Sharp argues that interaction design is about supporting people through interactive products which places the user in the focus. This varies from the definition from Cooper's which mean that interaction design lies in the practice of creation. Lastly, Moggridge presents a wider definition where all design that is both digital and interactive can be considered interaction design.

The discussion of whether interaction design can be seen as its own entity or requires the user in order to exist, as was shown by the comparison of definitions provided by Sharp and Cooper, is ongoing. Kolko et. al. provides another definition of interaction design as 'the creation of a dialogue between a person and a product, service, or system' and further states that the design 'lays dormant' until the user uses and understands the nature of the design [31]. Kolko and Sharp propose that the user is the center of attention concerning interaction design and Cooper and Moggridge suggest, through their definitions, that interaction design can be conducted without the user as the main focus.

The definitions presented above along with the discussions regarding interaction design provide no clear definition as to what interaction design means and what it means to perform it. The only consensus seen in these definitions is that the end product is interactive and that design is involved. However, in combination, these definitions provide some clarity as to what it means to perform interaction design.

### 3.3 Differences among users

In this section the differences among users, novices and experts, will be explored. It can be of importance to understand the polar opposite user group of the intended user base and also use this as an undertone for discussion. By understanding the differences among users one can more easily define and relate to the intended user group. Thus in the following paragraphs various aspects of differences among users shall be discussed.

Pousman et. al. mention that usage patterns of casual information visualisation systems are short but spread over a large period of time. The authors also mention that the users of such a system may not be suited to understand complicated graphs or charts. Also, that a small number of attributes such as colour, size and position is perhaps the limit of such a system where the audience is large and varying in skill set [2].

Several studies have been conducted in the area of information visualisation where focus has been on the differences among experts and novices among others Jarodzka et. al.. They discuss the idea of giving novice users access to the perceptual/attentional processes of that of experts [3]. This idea of aiding novice users by guiding them where to look or how to look at information in order to understand it and make the most of it is an interesting notion and one that will be explored during this project.

### 3.4 Mental models

The research of mental models and their affect on how users interact with an information visualisation system is also research that will be regarded within the thesis. Liu et. al. discuss that designing information visualisations is giving form to ones mental simulations [4]. Thus, one could argue that it is also possible to use mental models to interpret and understand information visualisations.

Mental models arise when interpreting images but the designer has no control over how well these mental models actually reflect upon the presented visualisation. Spencer mentions that a single piece of data can influence the result of the entire mental model [15]. Thus, it is important to consider all the factors of a visualisation and bear in mind what pieces of data are being visualised at any given moment. Spencer continues and discusses the complexity of this and argues that oftentimes data is multifaceted and encoding the data in a proper way can be a difficult task for the designer [15].

It is important to consider the mental model of the intended user and utilise it when designing visualisations. By providing visualisations that are close to the user's own internal model the user will more easily be able to relate, understand and use the visualisation efficiently.

## 3.5 Usability

A phrase that is common in the area of design is ‘Usability’. According to the Cambridge dictionary the definition of usability is, ‘... the fact of something being easy to use, or the degree to which it is easy to use’ [9]. One facet this definition does not address is for whom the artefact is easy to use. In interaction design the end user, the user who will end up using the design, will be considered the guide for the degree of usability. As argued by Gustavsson the term usability is often believed to be related to designing for novices and thus usability is striving for simplicity. Gustavsson continues by mentioning that the simplicity should be related to the knowledge of the end user. Furthermore, Gustavsson states that humans ‘not only respond to the logical facts within the interface but on the full context in which they are situated’ [10]. Thus, providing a context in which the end user is comfortable and efficient, largely regardless of their skill set, is vital in the strive for usability.

Researchers have long been searching and developing heuristics in order to achieve usability within a design. Among them are Schneiderman’s eight golden rules [11] and Nielsen’s ten usability heuristics. Nielsen’s heuristics [12] are defined in the list below.

1. Visibility of system status.
2. Match between system and the real world.
3. User control and freedom.
4. Consistency and standards.
5. Error prevention.
6. Recognition rather than recall.
7. Flexibility and efficiency of use.
8. Aesthetic and minimalist design.
9. Help users recognise, diagnose, and recover from errors.
10. Help and documentation.

Nielsen proposes a general set of guidelines to be used in all design work to achieve usability. Focus in this thesis will be laid both upon the graphical aspect of the design and on the interactions and usability of the design.

# 4

## Methodology

*"Only those who will risk going too far can possibly find out how far one can go."*

- T.S. Elliot

Through the development and realisation of this thesis several methods and methodologies have been used. Methods related to the development of the underlying system that drives the information into the visualisations and also methods that aid in ideation, prototyping, designing and gathering of data will be explored and discussed.

### 4.1 Methodologies

Several methodologies have been used during the time period of this thesis. These are presented in the following sections.

#### 4.1.1 Agile development

In order to conduct the development of the system explained throughout this thesis a development methodology had to be adapted. Agile development and its offspring Scrum was the chosen methodology. Scrum contains several key practices [5], as explained by Meyer.

1. Sprint planning.
2. Allow changing requirements in a controlled fashion.
3. User stories define the work to be done.
4. Daily progress tracking.
5. Usage of the term 'Definition of Done' in order to establish the progress.
6. Task board and burndown charts.

### 7. Sprint (iteration) review.

The usage of agile development enables the team to focus on the tasks at hand in a controlled fashion. User stories define what should be done in the eyes of the intended users. A basic example of a user story might be, ‘As a user I wish to login’. By viewing the task from the eyes of the user one can more easily connect with the intended user group of the system. Also, planning the sprint ahead of time allows the team to know what will happen and who will do what throughout the sprint. Furthermore, the daily planning phase lets the team discuss their progress and any issues they might be having. This allows for good communication throughout the team.

Defining each task and sprint when they are done increases the speed of development as each team member knows when a feature is done and does not linger on it. Lastly, a key feature of scrum is the sprint review phase where the sprint is discussed and each task is reviewed. This also allows for communication in the team and enhances the end product.

### 4.1.2 Participatory design

As developers have good knowledge over the system and how it works including users with domain knowledge can enhance the end product. As Yutaka states, ‘User participation is proposed as a means to tap into users’ domain knowledge’. Furthermore, Yutaka mentions that participatory design gives the user a sense of ownership and can thus make better use of the technology [6].

In order to provide the user with ownership over the final product users will aid in the design of the system. The users will be included through discussions, workshops and cooperative prototyping. By activating the user in many steps of the design process the user will influence the design and create ownership of the product.

In order to understand and activate the user group several methods within the field of participatory design will be utilised throughout this thesis. These are highlighted in the following paragraphs.

#### **Ethnography**

Ethnography is a method of researching where where the researcher observes from the point of view of the subject. By allowing the study to take place in a real world environment the complex nature of peoples actions can be observed in relation to the designed artefact [16]. This part of the design phase ties into the observations, described in the section Methods (Section 4.3). Ethnography will be used to gain insight into the behavioural patterns of the user when presented with mockups, paper prototypes or working parts of the system. This insight will then be used throughout the prototyping and design phases in order to guide the design work.

### **Cooperative prototyping**

As Bødker mentions, ‘The cooperative prototyping approach aims to establish a design process where both users and designers are participating actively and creatively based on their differing qualifications’. As designers and users collaborate on the design the relations between the user’s skill set and the possibilities of the artefact and technologies involved can be explored [17]. The design can then be iterated upon in order to reach a design both parties are satisfied with and can feel ownership of.

When initial designs have been created the user group intended for the design will be asked to aid in the betterment of these designs. Any questions, ideas, comments and feedback will be noted. The prototype will then altered by the user and designer in collaboration until a reasonable design has been reached.

### **Workshops**

Large parts of the system will be developed with the aid of the user group. Workshops will be used to allow the user group to enter into the shoes of designers and make their ideas heard. Also, workshops will be used as a tool to discuss design and the flow of the layout. The insight gathered in this step will greatly influence the design of the end product.

## **4.2 Design process**

Tying into the act of participatory design and involving the user in the design process has been heavily influenced by User Centred Design (UCD). As stated by Abras et. al. ‘The role of the designer is to facilitate the task for the user and to make sure that the user is able to make use of the product as intended and with a minimum effort to learn how to use it’ [7]. Placing the user at the centre of the design process enables the designer to enter the domain of the user and use this newfound knowledge during designing.

One must also consider the various levels of interaction each stakeholder has with the final product. As defined by Eason there are three different types of users: primary, secondary and tertiary. Primary users use the product directly, secondary users occasionally use the product and tertiary users are affected by the use of the product [8]. Knowing which stakeholder falls into which category will guide the final design and the involvement of each stakeholder group. Certain aspects of the design will not affect all stakeholder groups while others will have an impact across all stakeholder groups.

Placing the user at the centre of the design and involving them in workshops, mockup testing and prototyping gives the designer valuable insight into the user group that ultimately will use the product.

### 4.3 Methods

Several methods will be used when conducting studies throughout the time period of this thesis. These are listed in the following sections.

#### 4.3.1 Brainstorming

Brainstorming<sup>12</sup> has an important role in all forms of idea generation and development. Harnessing the mind and focusing ones energy on solving one particular problem or addressing a certain situation is a powerful tool. Brainstorming will thus been involved in all steps of the design process in order to provide new ideas and perspectives to the table.

#### 4.3.2 Interviews

In order to capture qualitative data interviews<sup>3</sup> will be conducted with the user group (novices). The interviews will be semi-structured in order for the interviewees to answer vital questions necessary for the research but also give room for an open discussion where interesting information can arise.

Interviews will be used during the prototyping and design phase as a compliment to participatory design. In order to get further insight into the user's mind and thoughts these interviews will be used to access these pieces of information. This data will then be used to better the prototypes and design. The interview questions used can be found in Appendix A (Interview questions).

#### 4.3.3 Observations

Observations will be used to find usage patterns among the user groups. Tasks will be presented to the users and the users will be expected to solve them in the manner they deem correct. The observer will take notes during these observations in order to get insight into the mind of the user. Observations will be used to gather data in the final user study which will be used to evaluate design and heuristics.

#### 4.3.4 Screen capturing

Users will also be asked to conduct tasks where they are alone and working within the system by themselves. During this time no questions will be asked and they

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<sup>1</sup><http://www.designkit.org/methods/1>

<sup>2</sup><http://www.designkit.org/methods/28>

<sup>3</sup><http://www.designkit.org/methods/2>

will conduct the tasks on their own. In order to capture this data a piece of screen recording software will be used to capture the users actions. A mic and web camera will also be used in order to capture eye movement, facial expressions and any sounds. This will be done in order to get an insight into how the different user groups work within the system when they are alone and how they navigate throughout the system. Also, it will give data regarding any emotions that arise in the user when they are handling the system such as frustration, anger, joy or accomplishment.

# 5

## Planning

*"Productivity is never an accident. It is always the result of a commitment to excellence, intelligent planning, and focused effort."*

- Paul J. Meyer

A time span of five months is the aim of the project. And below is a time table of the processes. It has been divided into four phases and these will be outlined in the following sections.

### 5.1 First phase

This phase will be six weeks long consisting of the items presented below.

1. Literature research
2. Prototyping
3. User Studies
4. Report writing

The first phase will consist mostly of finding a foundation of research to start building upon. Also, the prototyping phase will begin in cooperation with select novices and experts. During this phase user studies will be conducted in the form of interviews and observations which will guide the design of the prototype. Lastly, the writing of this thesis will be initiated.

### 5.2 Second phase

This phase will be six weeks long consisting of the items presented below.

1. Literature research

2. Design
3. User Studies
4. Report writing

During the second phase the literature research will continue but will be narrowed down into more specific areas such as information visualisation and usability. The prototyping phase will by now be ended and the design phase will begin. The design will be, similarly to the prototyping phase, conducted with the aid of users of the system in order to achieve a design suitable to the end user. User studies will be conducted during this phase, also in the form of observations and interviews regarding the development of the design in order to cooperatively develop the design. Lastly, further writing of the thesis will continue.

### **5.3 Third phase**

This phase will be six weeks long consisting of the items presented below.

1. Literature research
2. User Studies
3. Report writing

The third phase will further establish the literary foundation upon which this thesis will stand. More in depth user studies will be conducted in the form of tasks being given to users that they shall achieve. The result of these tasks shall be compiled and used as a guideline of which the design shall be measured. Lastly, the report shall continue to be developed.

### **5.4 Fourth phase**

This phase will be three weeks long consisting of the items presented below.

1. Report writing
2. Project completion

In the fourth and final phase the report will be finished and this thesis will have reached its completion.

# 6

## Designing visualisations

*"Design is not just what it looks like and feels like. Design is how it works."*

- Steve Jobs

This chapter charts the path on which the design has traveled. Starting with rough prototypes and later moving onto adding design and finally making the design interactive. The iterations are made visible through examples and figures in combination with discussions and evaluations. The prototype and design requirements are listed and throughout this chapter the prototypes and designs are evaluated against these sets of requirements.

### 6.1 Prototyping

Prototypes of the two distinct pages and their visualisations were initially created and then tested and discussed in order to be iterated upon. Focus, was laid on how the user would interpret the data at a glance in order for the process of accessing the data to be quick. Also, knowing which information should be dominant and if this felt natural to the user was tested. The interactions with the prototypes were also iterated upon.

#### 6.1.1 Prototype requirements

At the start of the prototyping phase several requirements were set for each prototype. These would be the guidelines that, in combination with testing, would be the benchmarks for which the designs would be tested. These requirements were developed together with SEO technicians and novices in SEO in order to provide a realistic set of goals. The requirements are presented below.

##### A. General

1. The visualisations must be easy to understand.
2. The design must not be cluttered with too much information.

3. Complex terms and expressions should be avoided.
4. Significant scrolling should not be necessary in order to access information.

## **B. Customer Front Page**

1. A visualisation of keyword rankings must be present.
2. Visualisations providing an overview of the website's SEO status must be present.
3. A domain competition analysis visualisation must be present.

## **C. Customer Keywords Page**

1. Detailed keyword information should be present.
2. A visualisation of the keyword's SERP result should be present.
3. A visualisation of the keyword's search volume (on Google) must be present.
4. A keyword competition analysis visualisation must be present.

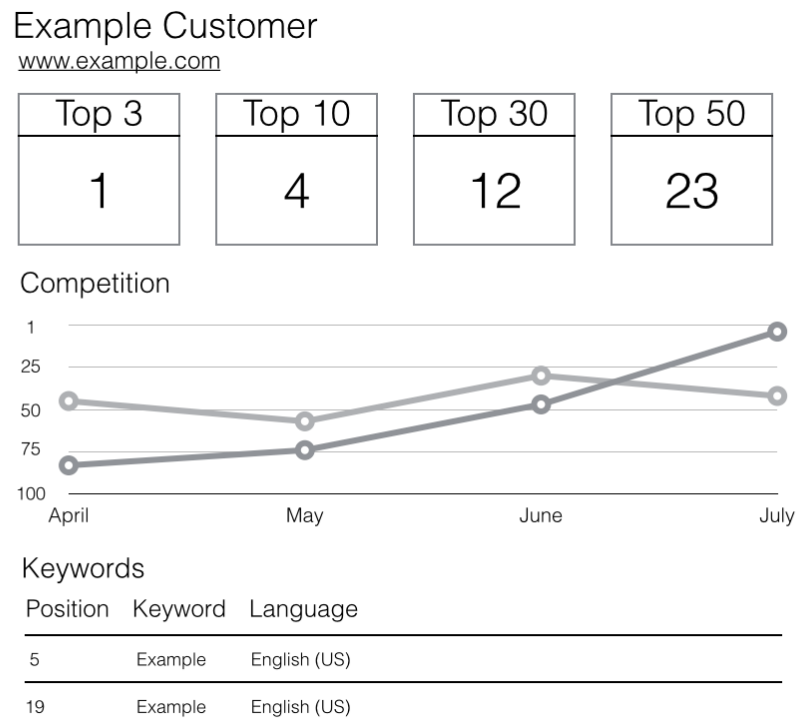
The first set of requirements are general and will be applied to all views. The following two sets of requirements will apply to their corresponding views. The purpose of these requirements was to create a benchmark for which the prototypes of the various iterations could be compared to. All requirements were considered key and thus all points were to be fulfilled before a prototype could be considered viable. Using this prototyping method proved useful in ranking each prototype against its previous iteration. The requirements were not as much a guideline during prototyping but more so afterwards. When the prototype was complete it was compared to the requirements in order to get an idea of how well it suited its purpose.

### **6.1.2 Customer Front Page**

In this section the various prototype incarnations of the customer front page will be explored.

#### **Iteration 1**

In this stage not much was known about how much or what data was to be displayed. Thus, in this prototype the only elements listed are four boxes at the top and the website's ranking keywords below (Customer Front Page). The four boxes contain how many top n rankings the website has at the moment. The keywords below are all the website's ranking keywords (all keywords the domain ranks on).



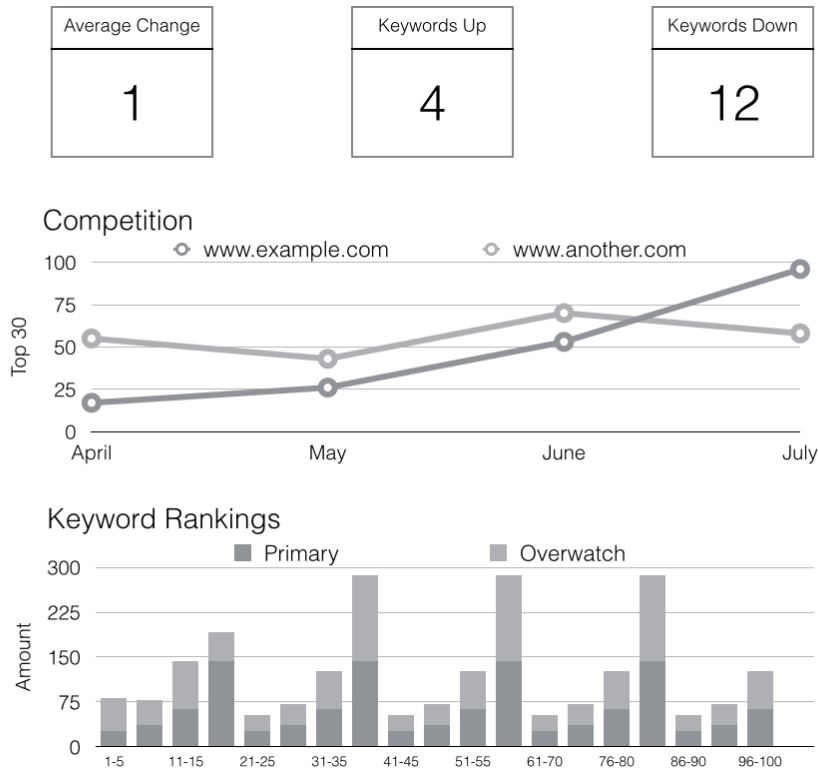
**Figure 6.1:** The initial prototype sketch of the customer front page.

As can be seen in figure 6.1 the customer's name and website is at the top of the figure. Below are the boxes displaying the website's amount of n rankings. The idea was to put a set of vital pieces of data immediately into view of the user. This would then allow the user to get an overview of how their general SEO efforts are going. After the boxes the competition analysis is presented in a line graph. This graph visualises the presented website's SEO status in contrast to other websites and their SEO status. Below is the list of all the keywords the website ranks on. At this stage it was not known how to display this data in a way that would make sense to the customer and without overwhelming them with a large array of data.

This prototype fulfils requirements A3, B1, B2 and B3. Keyword rankings are visualised through the table, there is an overview of the SEO status although not a very precise one, also the design avoids complex terms and notions. Furthermore, competition is displayed in the line graph. However, several faults were found with this line graph. No legend is available thus making it impossible to discern which website is which. Also, there is no clear indication of what the y-axis represents in terms of measurement thus failing requirement A1. Furthermore, the interface can become cluttered due to the table and it requires extensive scrolling if the table is large therefore failing requirements A2 and A4. Lastly, the visualisation of the table felt overwhelming and was thus not easy to understand for the user. This was the initial prototype but to find a good solution further iterations were necessary.

### A second iteration

After having discussed the prototype with the user group it was concluded that the initial prototype was lacklustre in the aspect of getting a quick overview. The boxes at the top (see figure 6.2) were appreciated but the sense of being overwhelmed was palpable. Thus, a revision to the prototype was made. Alterations to the boxes were made along with a histogram that was introduced in an attempt of increasing the ability to get information at a glance and reducing the need for an in-depth survey of the data.



**Figure 6.2:** The revised prototype sketch of the customer front page.

As seen in figure 6.2 the boxes have been changed not to reflect the amount of top positions but instead more generalised data, the total average change of keyword rankings since last month, the amount of keywords that have increased their positions since last month and finally the amount of keywords that have decreased their positions since last month. A legend and y-axis title has been added to the competition graph thus clarifying its purpose. The histogram visualises the amount of keywords that rank within a certain five interval long scope. We can see in figure 6.2 that there are five keywords that rank in the interval 1-5. This interval of one to five was chosen because it seemed to be the sweet spot as one to ten gave too low a granularity and anything lower would make the graph appear cluttered.

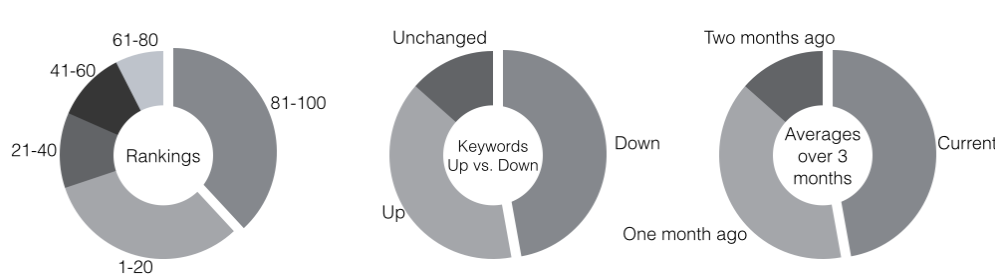
The totality of these changes was an attempt at providing the customer with visualised data that can give them detailed information about the SEO status of their website. Notice the removal of the table showing all the keyword rankings for the website. This alteration was a test to see if the histogram would suffice as a replacement for this table. During discussions regarding this prototype it became clear

that the boxes now needed more of an explanation as it wasn't as clear as to what they meant. The histogram proved successful and was helpful in the ability to get a quick overview of the of the website's SEO status. However, the removal of the table displaying all keywords the website ranks on was met with certain concern from the users. The table provided the customer with details that now were unobtainable. Thus, it became clear that a combination of overview and detail was necessary in order to provide a useful tool.

This prototype fulfils requirements A2, A4, B1, B2 and B3. The design is no longer cluttered with overwhelming amounts of data due to the removal of the table. Also, excessive scrolling has been eliminated due to the removal of the table and condensing its information into the histogram. The design contains a visualisation of the keyword rankings in the histogram. Also, there exists an overview of the website's SEO status. However, the visualisation of average change is not obvious and thus it fails requirement A1. Also, the term 'Average Change' is not transparent in its meaning and can cause confusion thus the prototype fails requirement A3. This prototype passes more requirements than its previous incarnation but it fails in certain aspects thus requiring further design iterations.

### A third iteration

In this iteration the SEO status was in focus as the competition analysis and histogram were considered ready to enter the design and interaction phase. The resulting prototype can be seen in figure 6.3.



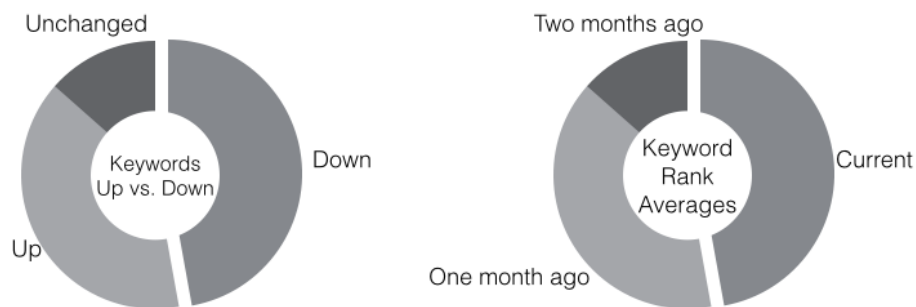
**Figure 6.3:** The third iteration of the customer front page.

The goal was to create a layout with visualisations that increased the ability to get an overview of the website's SEO standings. With this in mind the boxes were changed to donut graphs with the largest portion exploded from the chart. This resulted in an increased ability to determine which part of the data was most significant. Also, seeing the differences of the partitions using visualisations was more powerful than using only numbers. Donut graphs were chosen over pie graphs due to the fact that there was room in the middle of them for a descriptive text. This was attractive as it carries the same information load as a pie chart but with the addition of the possibility of adding a layer of description. Although, the donut graphs brought increased ability to get an overview the graph containing the rankings was considered superfluous as it contained the same information as the histogram below it. It was also noted that three graphs was a bit too much to grasp at a glance so it was proposed that the donut graph containing the rankings be removed.

This iteration of the prototype fulfils requirements B1, B2, A1, A3 and A4. The design contains a visualisation of keyword ranks, it also has an overview of the website's SEO status. These visualisations were deemed easy to understand and significant scrolling has been avoided, also complex terms have been avoided. However, it fails requirement A2 of being cluttered with too much information, in this case superfluous information. This prototype, due to only lacking on one requirement, is an improvement of the previous but still in need of design iteration.

#### A fourth iteration

As mentioned in the previous section, the histogram and competition graph were considered ready to enter the design and interaction phase thus leaving the donut graphs displaying the SEO status to be iterated upon. Only a few changes were made to the prototype before ending up with the one shown in figure 6.4. As mentioned earlier, the donut graph showing the rankings was removed, the name of the right most donut graph was changed to 'Keyword Rank Averages', or KRA as coined by this thesis, since this term was most clear as to what it meant. The donut graphs were given more white space between them in order to make them more distinguishable.



**Figure 6.4:** The fourth prototype of the customer front page.

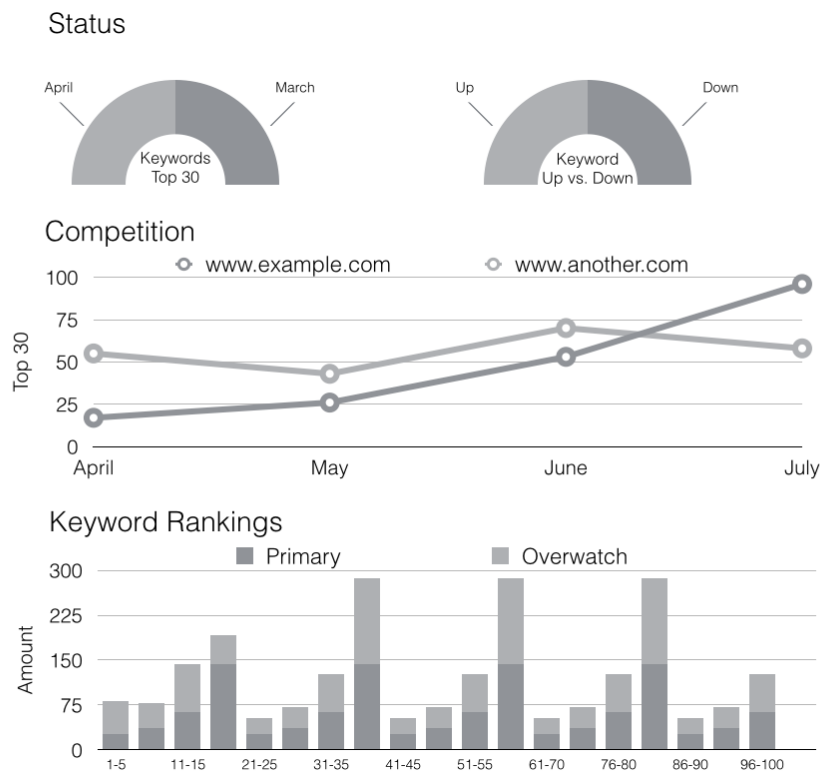
The combination of the donut graphs and the histogram provided the novice with a quick overview of the status of the SEO of their website. It also provided the option of seeing more details if this was necessary or desirable. The design itself is minimal and contains few visual elements, two donut graphs, one histogram and a line graph. Although, this is a stream lined interface it holds a large quantity of useful data.

This prototype fulfils all requirements. The keyword ranking visualisation is present along with the website SEO status. The design is no longer cluttered with too much or superfluous information. The interface is deemed easy to understand and complicated terms and expressions are avoided. Lastly, scrolling has been eliminated and all information is available at a glance. Although this prototype fulfilled all requirements defined at the start of the prototyping phase there was a concern that the data displayed in the donut graphs were not ideal. Even though KRA was a good measurement of SEO it was in some cases confusing as to exactly what it meant. Furthermore, an idea of reducing the size of the donut graphs emerged. A round object inside a square container (the webpage) will always 'waste' space so it was decided this was to be one element iterated upon in the next iteration. Thus,

another attempt of improving this prototype was initiated.

### The final prototype

As mentioned in the previous section the term KRA was successful in most cases but an undertone of difficulty was brought to light. In order to get to terms with this difficulty a discussion was raised to find a new measurement that was at least equally efficient in determining a website's SEO status. The idea of using the amount of top thirty positions was considered. As mentioned in section 2.2.2 (SERP) after position thirty the CTR dips below double digits and this was deemed the breaking point for a decent rank for a website. Thus, the amount of top thirty positions was deemed a viable measurement. The resulting prototype is seen in figure 6.5.



**Figure 6.5:** The final prototype of the customer front page.

As seen in figure 6.5, removing KRA was not the only alteration made. The 'unchanged' partition of the KUD graph was also removed in order to increase simplicity. Also, reducing this partition to two made sense since the new donut graph displaying the top thirty positions also was given two partitions. This was an effort in creating coherency throughout the design. By making the graphs appear similar their relation to each other increased. Furthermore, the annotations were given more meaningful names such as 'April' and 'March' thereby providing more detailed information about when the data was acquired. Before these annotations were less vivid in their temporal meaning and they simply stated how long ago they were acquired, e.g. 'two months ago'. By providing more meaningful names more detail was available without adding complexity. Lastly, the donut graphs have been reduced to semi circles. This was the resulting alteration made in an attempt to be more space efficient. Furthermore, the partitions within the donut graphs have now been pulled

in and no partition is sliced to appear more proud. This, was altered because several test subjects asked if this was a design error and thus this was changed. Because of this it is no longer clear which partition is largest. This will be attended to in the design and interaction phase.

This prototype fulfills all requirements and is also a betterment of the previous prototype which also fulfilled all requirements. Thus, this was considered the final prototype.

### 6.1.3 Customer Keywords Page

As mentioned in the previous section the table detailing keyword rankings was removed in order to provide less clutter. This table is the backbone within the customer keywords page. This table lists all keywords belonging to a website along with details regarding those keywords. This table can be seen in figure 6.6.

Keyword Rankings

Position	Keyword	Language	Change	Global Searches	Local Searches	
5	Example 1	English (US)	+2	14000	6000	<a href="#">Details</a>
19	Example 2	English (US)	-3	2000	250	<a href="#">Details</a>
8	Example 3	English (US)	+2	20000	12000	<a href="#">Details</a>
76	Example 4	English (US)	-3	48000	23000	<a href="#">Details</a>
34	Example 5	English (US)	+2	100	10	<a href="#">Details</a>
53	Example 6	English (US)	-3	3600	1400	<a href="#">Details</a>

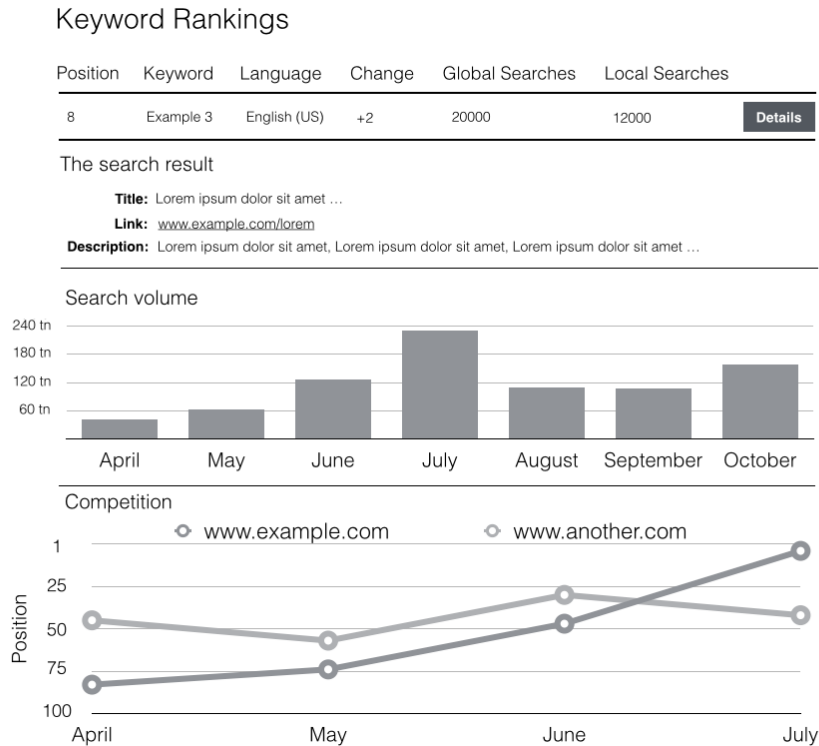
●  
●  
●

**Figure 6.6:** The table displaying customer keywords.

As mentioned and seen in figure 6.6 this table provides the user with a list of all keywords belonging to their website. The table lists: SERP position, keyword, keyword language, change in position (since last month), global and local searches (search volume on google) and a details button. The table itself will endure no iterations as it is considered to hold all vital pieces of information. However, the view which will appear after the user clicks on the details button will be iterated upon in the following sections.

### Iteration 1

The first attempt was to use an accordion inside the table to display the data. When a user clicks the details button of a keyword that row would expand downward and reveal the details corresponding to that keyword. Accordions are common in tables and this fact was an attempt to utilize a common method of displaying data into the design. The resulting prototype is shown in figure 6.7.



**Figure 6.7:** The initial prototype of customer keyword details.

As seen in figure 6.7, the keyword (Example 3) that was clicked on is shown at the top. At the top of the expanded view is the keyword's search result. This correlates to what the user would see if they searched on Google for that keyword and looked at the result that matched their domain and link. The result consists of a title, link and description and are the parts that make up a search result. Below the search result is the historic search volume for this keyword. A histogram was chosen since it had previously been used in the customer front page and thus the user would feel somewhat familiar with it. Lastly, the competition of this specific keyword is visualised through a line graph, which has also been used before. The competition graph shows how the given website has ranked on a certain keyword over time compared to its competitors.

This prototype meets the following requirements: A3, A4, C1, C2, C3 and C4. As the information is fairly condensed excessive scrolling has been eliminated. However, the resulting design is cluttered thus failing requirement A2. Furthermore, due to the visualisations being condensed their understandability takes a hit. The cluttering of the interface affects the efficiency of which the user can understand the interface. This results in the prototype failing requirement A1. Complicated

terms are avoided and no issues with language were perceived through out testing this design. Furthermore, the prototype fulfills all view specific requirements (C). Keyword information, keyword SERP result, search volume and competition are all visualised within the prototype. However, this prototype requires further iteration in order to fulfill the necessary requirements.

### The final iteration

In order to deal with the cluttered layout resulting from the previous prototype modularisation was introduced. The three pieces of information: Search result, Search volume and competition are independent of each other thus the idea of breaking them apart was hatched. The details button was split into three representing the various alternative pieces of information. This resulted in the following redesign of the table.

Keyword Rankings

Position	Keyword	Language	Change	Global Searches	Local Searches	
5	Example 1	English (US)	+2	14000	6000	Details

Search result

Search volume

Competition

**Figure 6.8:** The expanded details list.

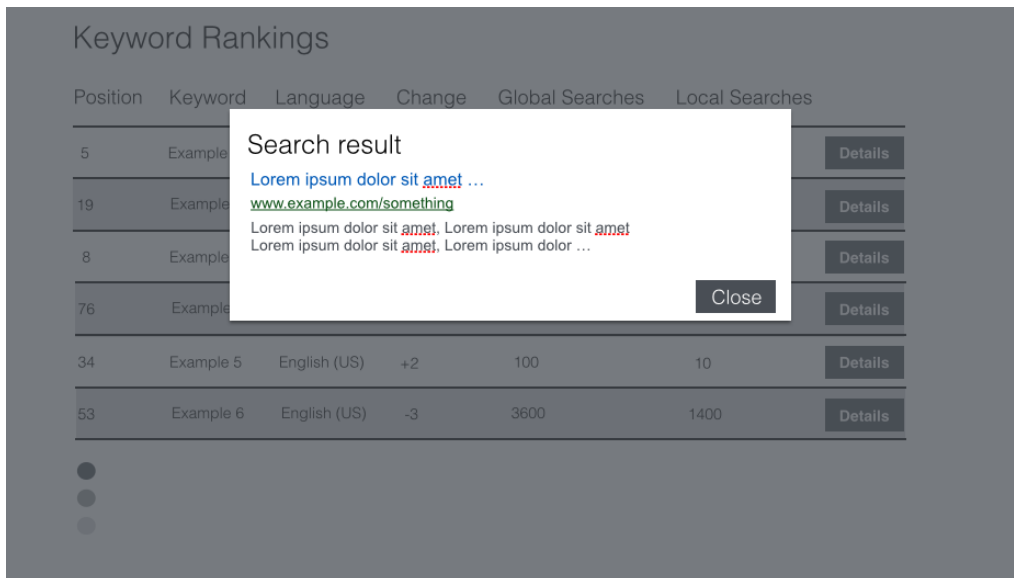
The details button now expands to the right (as seen in figure 6.8) where there is white space at the moment. By expanding to the right no information in the table is blocked from view by the expanded details list. Also, by providing a selection of which view to inspect the system allows to be modular in the sense that new views can be added in an elegant fashion.

Furthermore, the use of expanding the table to view the details was altered in this design in favor of modals (panel overlays similar to popups). By using an accordion within the table more details is added to the table which in itself contains a large deal of information. Thus, modals were used in this prototype to test their effectiveness. When the user chooses an option in the details list a modal containing the information will appear, as seen in figure 6.9.

The modal places an overlay on the page in order to increase focus on the modal and also reducing the background noise emitting from the rest of the page. When the user is done examining the contents of the modal he or she can either press outside the modal or on the close button in order to close it. This modal is used for all three detail views using the same visualisations presented in the previous section.

The keen reader will have noticed the alteration of the visualisation of the search result. It has been changed in order to reflect how a search result is represented on Google's search engine. By resembling the real world object the user's mental model of the data and the representation are almost identical in this case.

This prototype fulfills all requirements as cluttering has been eliminated from the design. The use of modularity and modals greatly increased the usability and un-



**Figure 6.9:** Modal showing the search result for a keyword.

derstandability of the prototype resulting in this being the final iteration of this page.

### 6.1.4 Prototype evaluation

Before we move onto the design phase let us examine the prototypes more deeply. In this section we will evaluate the prototypes by using certain information laid out in section 3 (Theory) in order to establish the validity of the prototypes before moving on towards the design phase.

#### Perception

As mentioned in section 3.1.1 (Perception and benefits) Card et. al. have developed guidelines to aid in the designing of visualisations. In this section the proposed prototype will be evaluated using a selection of these guidelines.

Firstly, the customer front page has eliminated any major navigation and places all its information at immediate disposal to the user. The term WYSIWYG (What You See Is What You Get) comes to mind. Thus, the idea of 'reducing search for information' has been embedded within the prototype.

Secondly, the donut graphs on the customer front page are similar in size, number of partitions and placement. Furthermore, the layout uses rows and columns that result in a pattern of sections on the page. This combination provides the 'recognition of patterns'.

Lastly, the permitted action of viewing more details in the customer keywords page can be argued to 'enable a perceptual inference operation'. By getting more details one can draw more precise conclusions given the data at hand.

### **Visualisation facets**

The parts within section 3.1.2 (Visualisation facets) that will be used in this section are the Gestalt principles and the cognitive abilities of humans regarding the attention span.

In order to tackle the limitation of the human attention span and using the magical number of seven the Gestalt principles have been used. The prototype is minimalistic in nature and presents data in an 'at a glance' fashion. The Law of Simplicity from the Gestalt principles states that a visualisation will be interpreted in the simplest way possible. Thus, the visualisations have been designed to be simple to begin with. Also, the Law of Proximity and Similarity will be in effect due to the placement of the visualisations and their connectedness there through. By utilising the Gestalt principles the resulting prototype requests little of the user in form of necessary attention. Due to the lack of clutter or detailed information the attention span will in return not be cluttered and can be let to focus on the information at hand.

## **6.2 Adding design and interactivity**

The final prototypes would now be adorned with graphical design along with the addition of interactivity. The purpose was to create interfaces that were both efficient in their layout and provided good information but also pleasing to look at. Also, design that complements the interfaces in such a way that it would increase the usability of the interface. Thus, requirements for the design and interactivity were created. These requirements are presented in the following section.

### **6.2.1 Design and interaction requirements**

In the same spirit that influenced the requirements for the prototyping phase these would also become guidelines for which the designs would be benchmarked against. These requirements were created, as previously, with a team consisting of SEO technicians and novices. The requirements are presented below.

1. The addition of design should enhance the understandability of the interface.
2. The addition of design should enhance the usability of the interface.
3. Interactions must not be necessary in the understanding of an interactive element.
4. The aesthetics of the design should provide a pleasurable working area.

The terms understandability, usability and aesthetics are not the most trivial of measuring points. Proposing that e.g. the understandability has been increased due to the design is often a perilous thing to do since the understandability for one group

of people might have increased but decreased for another. Thus, the resulting data will contain bias as the testing group will be a small set of individuals and the data that will be extracted from the tests will be further biased by the analysis of the data. Nonetheless, the measurements are important in rating the design as efficient toward this specific target group. But keeping in mind that the results are biased is important when working with qualitative data.

### 6.2.2 Designing visuals

#### Customer Front Page

The initial focus of the design phase was the donut charts displaying the SEO status of the website. The resulting design is seen below in figure 6.10.



**Figure 6.10:** The design of the SEO overview on the customer front page.

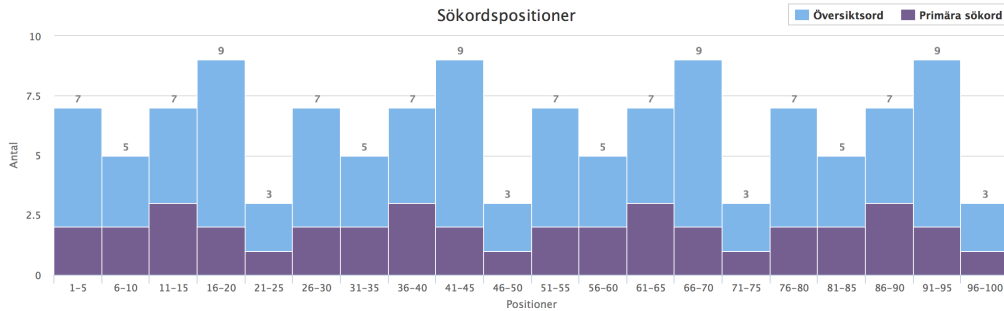
As seen in figure 6.10, the donut graphs displaying the SEO status of the website have been coloured. The colours black and blue were chosen because it was found during testing that the color black was associated with negativity or recession. Thus, using the color black on the partition that was the smallest was an efficient way of mediating information to the user. The color blue is neutral and holds no special meaning in its own in this design. However, due to the fact of one partition being associated with negativity it stands to reason (and was shown during testing) that the other would be associated with the opposite (positivity). Another reason as to why the colours black and blue were chosen was because they are visible to optically impaired users. The colors red and green portray the same information (positive and negative) but they would be inappropriate to use in this setting were the user base is large and users can be visually impaired.

Also, as might have been noticed, the language used in the design has been changed to the native language of the users, Swedish. As the system was to be used by swedes the language was changed in the design phase to reflect this.

Stating for a fact that this design meets all its requirements is impossible, due to the inability to measure them without bias. However, a discussion will be held which will analyse the design's ability to meet them. As for requirement one and two, the addition of colors to the donut graphs has added more information to the design. This was found during testing as more users were able to at an instant note which partition was the smallest. Furthermore, as colour was added the design seemed more alive and enjoyable to look at. As the design also holds minimalistic traits it

is non-complex and was deemed by the test subjects to be provide and aesthetically pleasing working environment. Lastly, interactions with the visualisation is not necessary to understand or use it as it provides information in its size and colour.

Let us move on the to design of the histogram which holds the website’s ranking keywords. The resulting design is shown in figure 6.11.



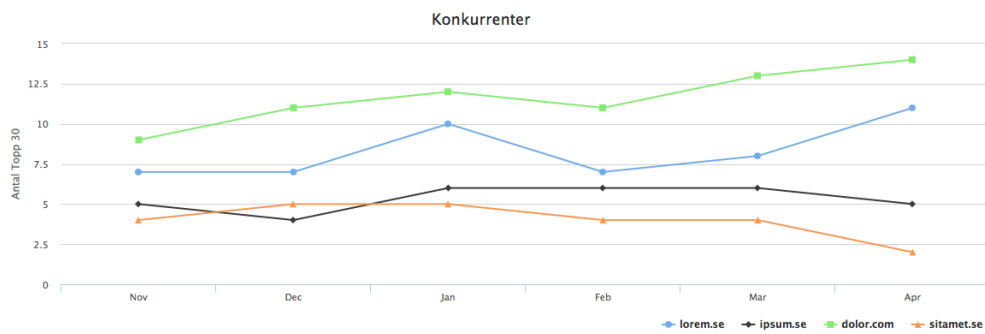
**Figure 6.11:** The design of a website’s rankings on the customer front page.

In this visualisation the intent was not to visualise any positive or negative trends, the goal was to efficiently visualise the amount of keyword rankings a given website has in any given position interval. Thus, the colouration of the bars in the chart hold no meaning other than the type of keyword they represent (primary or overwatch as mentioned in 2.2.3), which is also clarified by the legend at the top right. Another important facet about the colours chosen in this visualisation is that their differences are visible to both users with normal vision and those with optical impairment.

The numbers at the top of each bar is the combined total of that column. For example, in the left most part of figure 6.11 the combined total of that bar is seven and the bar at its right has a total of five. Instead of placing additional numbers within each partition of each bar, which provided more cluttering to the design, only having the combined total was deemed more visually pleasing and more efficient to use.

As with the previous visualisation the colours have made the various columns and partitions more discernible. Colors make the various different partitions easier to recognize and the efficiency of getting information at a glance has been improved. Also, as mentioned, not cluttering the visualisation with numbers within each partition provides a clean and non-cluttered working surface. Furthermore, the legend provides information as to which colour corresponds to which type of keyword further simplifying the design. Thus, the combination of these have fulfilled both the first, second and fourth requirements. Also, as in the previous visualisation, interactions are not necessary to use or understand the visualisation. The numbers at the top of each column and the size and colouring of the partitions allow for an understanding of the graphic without the need to interact with it thus fulfilling the third and final requirement.

Lastly, we will explore the design of the competition analysis line graph. The proposed design is visualised in figure 6.12.



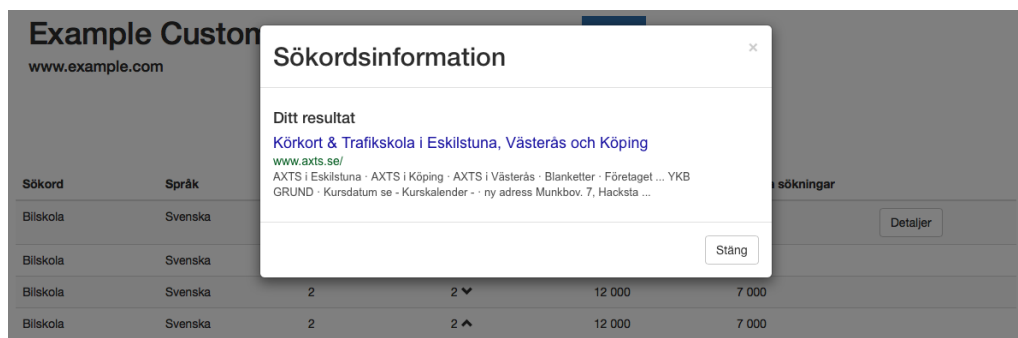
**Figure 6.12:** Design of the competition analysis visualisation on the customer front page.

There are many similarities to the original prototype of this visualisation yet there are some differences worth noting. Firstly, The legend has been moved to the bottom right of the visualisation. Secondly, the data points have been reduced in size and the different data points use different symbols. Lastly, more lines have been introduced in order to simulate a real world example.

The design is minimalistic, structured and unobtrusive in nature as per intention and the design requirements.

### Customer Keywords Page

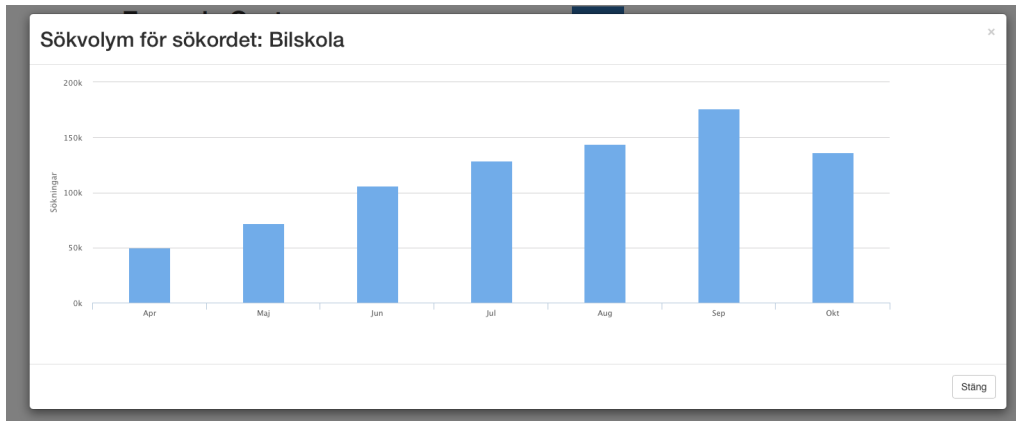
The search result view was the first of the modals to have design added to it. The resulting visualisation is illustrated in figure 6.13.



**Figure 6.13:** Design of the search result modal.

As seen in figure 6.13, the design is similar to its prototype counterpart. The same use of a transparent overlay is utilized in combination with a drop shadow on the modal. This combination focuses the eye on the modal and the shadow allows it to rise up from the background further illustrating it as its own object. Next, the modal displaying a keyword's search volume was designed, as seen in figure 6.14.

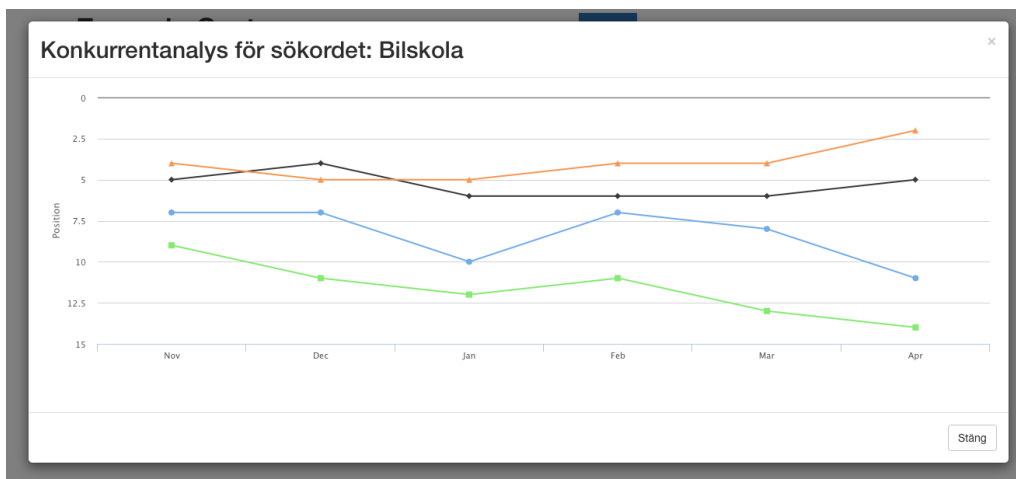
At the top is the title of the modal which also, as previously, lets the user know which keyword this graph corresponds to. As this modal is quite large it is important the user has all the necessary pieces of information when considering this visualisation. Forgetting which keyword the graph relates to would lower the efficiency of the design



**Figure 6.14:** Design of the search volume modal.

as the user would then have to close out the modal and reopen it after finding the correct keyword again. Furthermore, the same color has been used in all columns as the data is of the same type and the only difference is temporal, which month the data belongs to. Also, note that no numbers are visualised regarding each bar's size. This is an effort to minimalism and reducing clutter and also promoting the idea of getting information at a glance. The design lets the user view the graph and note trends instead of numbers.

Lastly, the design of the keyword competition analysis will be displayed. Please consider figure 6.15 below.



**Figure 6.15:** Design of the keyword competition analysis modal.

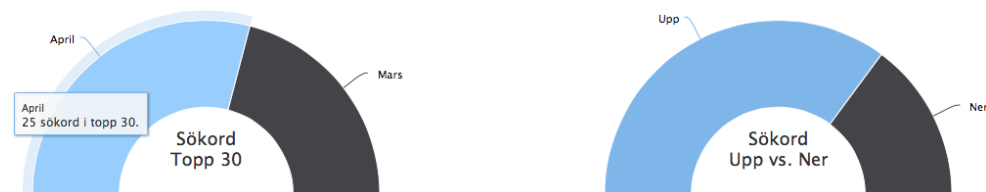
The graph visualised in figure 6.15 is of the same type as of that on the customer front page. This was a conscious choice in order to promote coherency. By using similar visualisations in order to display same types of data the user will feel more comfortable and learn the system faster.

### 6.2.3 Interactions

#### Customer Front Page

The proposed design does not provide a great deal of detail, as was desired. However, the details have been embedded within the visualisations and are accessible through a series of interactions. The underlying influence on these interactions, as with the visualisations, have been simplicity and minimalism. The interactions provide extra information that a user can choose to use in order to get more detailed information. However, these interactions are not meant to be necessary, as seen in the requirements. The interactions within the visualisations are presented in the following sections.

Any indication of measurable quantity has been removed from the donut graphs in order to provide simplicity. Interactions will provide the user with more detailed information regarding the actual numbers behind the visualisation.

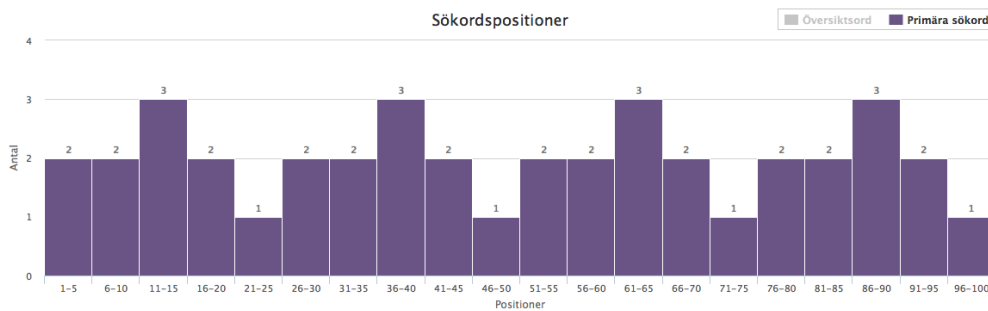


**Figure 6.16:** The interactions of the donut graphs on the customer front page.

As seen in figure 6.16, the left donut graph is being hovered over. The user, using the mouse cursor, hovers over the left partition in order to get more information regarding the size of this portion of the visualisation. The partition hovered over will also provide additional information that will let the user know which partition they are hovering over. This is useful if the mouse cursor is close to another partition thus eliminating any misconceptions about what partition the details regard. This interaction design pattern is effective when you want to show an overview and provide details through interactions [34]. Another important facet to note about this interaction is that the tooltip will appear at the location of the mouse cursor. This means that the tooltip will always appear where the user is looking as one often follows the mouse cursor while guiding it. The tooltip will also follow the mouse cursor if it should move and it will disappear if the cursor were to leave the vicinity of the partition. Furthermore, as mentioned, the tooltip will move with the cursor but important to note is that it will do so in a fixed position relative to the cursor, in this case, about 20 px (pixels) above the cursor. This dynamic yet static behaviour of the tooltip provides good usability as it follows the eye and remains readable as it does not perform any motions on its own but remains predictable. Also, the text provided in the tooltip is a readable sentence and not only numbers or symbols. The alternative would perhaps be some form of shorthand, e.g. 'Topp 30: 25' or 'Topp 30: 25 keywords'. Using any of these shorter versions more detail is provided in less space, although positive this representation is far more arbitrary (see section 3.1.2, Representations). By providing the user with a more arbitrary

representation more confusion is prone to arise rather than if regular speech/writing is used. It is also important to note that the important words have been nestled within the sentence: 'Topp 30', the amount '25' and the phrase 'keywords' are all present. By using the same terminology the user is more likely to feel familiar with the statement and its meaning.

Let us continue with the interactions of the visualisation which depicts the website's keyword rankings. This visualisation contains more interactions than its aforementioned counter part, the first to be shown is visualised in figure 6.17 below.

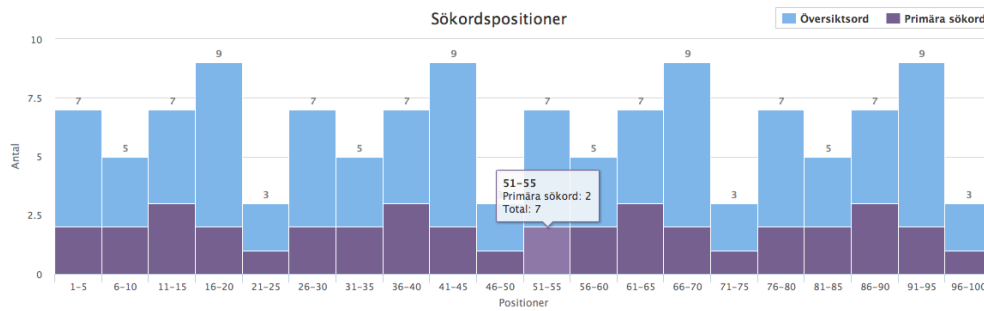


**Figure 6.17:** Toggling of partitions in a website's keyword rankings.

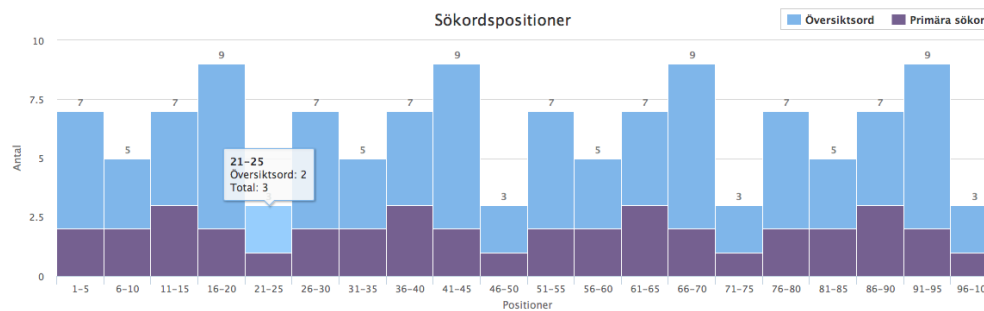
As illustrated by figure 6.17 only the primary keywords are being displayed. This has been achieved by clicking on the item in the legend labeled 'Overwatch keywords'. By clicking on a legend item it will toggle in and out of view. Thus, if both items are visible at first and the overwatch item is clicked it will disappear from view leaving only the primary keywords to be shown, as seen in figure 6.17. This is an important mechanic as it allows for deeper inspection of the relations between the various bars in the visualisation. Also, if the partitions for e.g. primary keywords were small compared to the overwatch keywords it can be useful to view the primary keywords in their own scale, as the visualisation dynamically scales according to the visualised data within it. Thus, by viewing a select portion of the graph more detail can be achieved.

As with the donut graphs visualising the website's SEO status, the action of hovering over a partition will provide the user with a tooltip containing further details. This tooltip is visualised in figures 6.18 and 6.19.

## 6. Designing visualisations



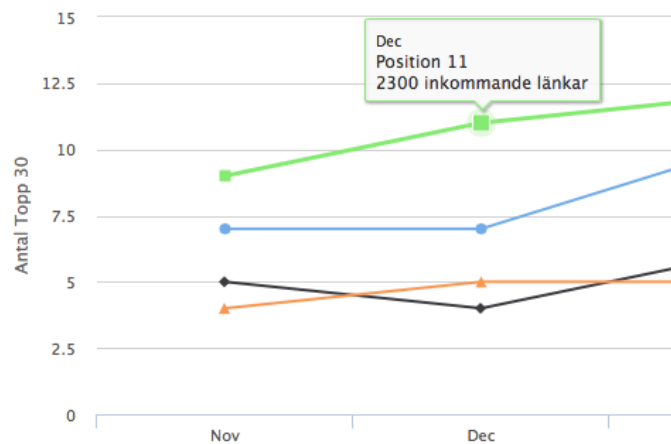
**Figure 6.18:** Tooltip displaying details of a partition in the website’s keyword rankings visualisation.



**Figure 6.19:** Tooltip displaying details of a partition in the website’s keyword rankings visualisation.

As seen in figures 6.18 and 6.19 the tooltip is displayed at the top of the portion which is being hovered over. The tooltip provides an indicator as to which portion it belongs to as well as the portion itself being highlighted for further detail. By hovering over a partition the user is provided with more details regarding the partition hovered over. As seen in figure 6.18 a portion of primary keywords in the interval 51-55 is being highlighted. The tooltip displays the interval of which the partition belongs to and how large the selected portion is along with the total size of the column. In this case, the selected portion has a size of two and the total size of the column is seven. In contrast to the tooltip in the donut graphs which had explanatory sentences this tooltip contains shorter versions. This was done because the tooltip contains two sets of data: the amount of the portion being highlighted as well as the total amount of the column. If a sentence were to be created of this it would provide unwanted complexity as multiple numbers and terms would be intertwined. By providing this alternative representation the relationship between the sizes is more apparent thus providing the user with a more powerful comparative tool. Furthermore, the interval is provided at the top of the tooltip in order to make it clear to which interval the highlighted partition belongs. This is necessary because the partition might be high on the y-axis thus making it more difficult to discern as to which interval the partition belongs to.

Lastly, the interactions of the domain competition analysis visualisation will be explored. Please consider figure 6.20.

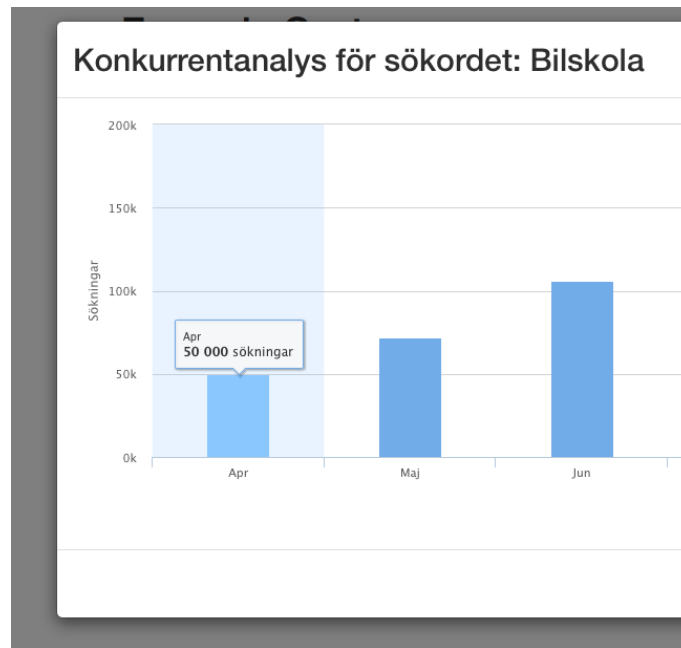


**Figure 6.20:** Tooltip displaying details of a data point in the domain competition analysis visualisation.

The tooltip belongs to the green line which is visualised by the placement, name and border color of the tooltip, as seen in figure 6.20. This is important as lines might intersect and otherwise cause confusion as to which data point the tooltip belongs to. Also, when a data point is hovered over with the cursor the data point and its line will enlarge in order to further notify the user which line and data point is selected. Furthermore, the data point that is being hovered over will show a shaded circle around it which will even further highlight which data point that is being selected. This is a good example of Tidwell's design patterns Data Spotlight and Datatips [34]. This combination of interactions and reactions give the user all information necessary in order to form an opinion as to their selection and its meaning. Also, within the tooltip the amount of incoming links (as mentioned in section 2.2.4) is also present. The amount of incoming links gives the user additional information that will aid in the usability of the design. By providing the amount of incoming links at a data point the user can draw conclusions as to why the graph behaves as it does. If there is a dip between two points and the user sees that the amount of incoming links has drastically dropped a conclusion as to why can be drawn.

### Customer Keywords Page

The visualisations provided on the customer keywords page does not provide a great deal of detail but instead focuses on getting an overview and visualising trends. Details are provided through interactions and they will be explored throughout this section. As the search result visualisation, seen in figure 6.13, is static it does not provide additional interactions, all of its data is readily available to the user. The modal displaying the search volume is on the other hand interactive, as seen in figure 6.21.



**Figure 6.21:** Interactions within the search volume visualisation.

When a bar is hovered over with the mouse cursor additional information is presented to the user, as seen in figure 6.21. The column in which the bar resides is highlighted in order to further enhance the user's selection. This feature can be crucial if the graph contains multiple columns in close proximity. Furthermore, a tooltip is presented to the user providing the amount of searches for that specific month. All this information exists within the tooltip: the month and the amount of searches. Even though the month is present at the bottom of the column it is important to provide this information within the tooltip. If there are many columns and the selected column is tall then it might be difficult to form an opinion as to which column the tooltip belongs. Furthermore, by providing the term 'searches' after the amount it is more clear as to what the information means in contrast to only presenting a number. The text becomes readable and a more familiar representation is used.

As the visualisation displaying the keyword competition analysis is similar to the domain competition analysis visualisation its interactions are also similar. Therefore, they will not be examined as no new information will be brought to light.

# 7

## User study

*"To acquire knowledge, one must study; but to acquire wisdom, one must observe."*

- Marilyn vos Savant

The first user studies were conducted before prototyping began and were first discussed in section 6.1.1 (Prototype requirements). The requirements developed at that stage were the result of interviews and observations regarding how similar tools were used and how the tool proposed in this thesis were to function. In order to validate the final design several tasks were created for the target group (novices) to perform within the system. These tasks are listed in the following section.

### 7.1 Tasks

In order to rate the various parts of the design as efficient or inefficient measuring points were necessary. Time to perform the task, amount of errors and user experience provide good measuring points [30] thus they were chosen. The time and amount of errors are quantitative measurements but the latter is qualitative. Thus, the user experience was rated on a scale from one to three where one was a pleasurable experience, two was an indifferent experience and three was a bad experience. This resulted in three quantitative measurement points on which the design could be benchmarked. The tasks to be performed are related to the requirements set out in section 6.1.1 as these were the guidelines for this design. These tasks are listed below and their corresponding results are presented and discussed in the following sections.

1. Determine how many keywords (primary and overwatch) are ranked between 1 and 10.
2. Determine how many primary keywords are ranked between 21 and 30.
3. Determine if the SEO status is positive or negative.
4. Determine the amount of keywords that have increased in ranking since last month.

5. Determine how well your website ranked compared to its competition this month.
6. Determine how well your website ranked compared to its competition 3 months ago.
7. Determine the title of any keyword's search result.
8. Determine the current month's search volume for any keyword.
9. Determine the current position of any keyword.
10. Determine the position of any keyword 2 months ago.

## 7.2 Test results

Each task was to be tested independently and no bias from previous tasks should contaminate the data. Also, it was necessary to provide a large sample size in order to establish the validity of the results. When samples reach thirty in size the distribution becomes normally distributed [32], which is desired. Therefore, a total of thirty users were used as subjects and each user received the order of tasks to be completed at random thereby reducing the bias of the tests. The subjects were taken from several different groups colleagues, customers and friends. All subjects were novices within the field of SEO at the time of the test's execution. When all tasks were completed by the subjects the data was averaged in order to extract the mean values defining the performance of each task. The results of these tests are presented in table 7.1 below.

Task nr	Time (s)	Errors (amount)	User experience (1-3)
1	5	1	1
2	9	3	2
3	3	0	1
4	3	0	1
5	8	2	1
6	14	6	3
7	6	0	1
8	12	2	1
9	13	2	2
10	18	6	3
<b>Average</b>	<b>9.1</b>	<b>2.2</b>	<b>1.6</b>

**Table 7.1:** The results from the user tests.

In order to establish the success or failure of the final design three ratings were established for each aspect to be tested. These ratings were used to compare the final user test results to a benchmark in order to establish its validity. The numbers

presented in table 7.2 are derived from user testing by experts and then bottom and top benchmarks were found. The neutral is the mean of the upper and lower benchmarks.

Aspect	1 (Good)	2 (Neutral)	3 (Bad)
Time	8	10	12
Errors	2	4	6
User experience	1	2	3

**Table 7.2:** The benchmarks for the user test.

### 7.3 Evaluation

As we can see by examining tables 7.1 and 7.2 the results fell in well into the benchmarks. The average time it took users to complete the tasks was 9.1 seconds which is almost precisely in between Good and Neutral on the scale. Therefore, the design performs well when it comes to users being able to use it quickly and not having to bog down into details. Furthermore, the average amount of errors produced by the users was just over two per task, 2.2. This result was positive as it placed just over Good in the benchmark. This may very well be a result of the users not having to perform many actions in order to achieve a task but can get information at glance and not have to interact with the interface to a great extent. Lastly, the average rating of user experience was 1.6 which is slightly further towards Neutral than Good. Achieving this good a score out of thirty subjects suggests further that the interface is indeed pleasurable to work with and that it provides an aesthetically pleasing working area.

Some tasks, as seen in the results, took much longer time to execute than others. Tasks 6, 8, 9 and 10 have been distinguished as the most time consuming tasks providing an average executing time of 14.3 seconds well over the benchmark noting bad times. Task 6 has the user locate a historic point in a line graph. As seen by the results this was a more difficult task than presumed. The users had some difficulty with this task proven also by the amount of errors produced by this task, 6, which is the amount that results in a Bad amount of errors. Also, the user experience result for task 6 was 3 which is a Bad experience. All in all task 6 proved to be time consuming, error prone and provided a bad user experience. Task 10 is similar to task 6 in many ways as it has the user compare against a historic point in a line graph. Task 10 also proved to be difficult as it provided worse results than task 6. In task 8 users were to use the search volume modal in order to locate the current month's search volume for a keyword. This proved to be fairly time consuming although this can be somewhat explained by the use of a modal. This task proved to provide a pleasant user experience and it was also fairly error free. Task 9 performed fairly similarly to task 8 although it did result in a lower user experience score. Task 9 was a surprise as the position of a keyword is located within the table, directly in view of the user. However, the users, in almost all cases, used the keyword position modal

## 7. User study

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in order to locate the position of the keyword. This resulted in a time consuming and fairly lacking user experience.

However, as mentioned previously the average scores of the user tests falls into the acceptance within the benchmark requirements thus suggesting the validity and efficiency of the design.

# 8

## Developing Heuristics

*"Start by doing what's necessary; then do what's possible; and suddenly you are doing the impossible."*

- Francis of Assisi

As mentioned in the introduction (chapter 1) a goal of this thesis is to find a set of heuristics that can aid the design of SEO visualisations intended for novices. In this chapter this endeavour shall be embarked upon. An exploration of theory and design in the following sections attempt to result in this set of heuristics.

### 8.1 Discerning heuristics

Throughout the prototypes, user testing, designs and discussions concerning this thesis work several ideas and concepts have emerged multiple times as key values. These values permeate the resulting concept and its implementation. These values were then turned into heuristics. These heuristics are presented below and in the following sections they will be discussed and examined further to establish their heritage and validity.

1. Use graphical visualisations to display generalised SERP data e.g. amount of Top 30 keywords, Keyword Rank Averages or Keywords Up vs. Down.
2. Provide interactions in order to bring forth detail, for example providing tooltips on data points in a line graph.
3. Use graphical visualisation(s) to present keyword rankings (SERP data) in e.g. a histogram.
4. Avoid the use of complex terms, expressions, notions or representations.

The idea of presenting a marker of SEO status arose at the beginning of the prototyping phase. The idea of giving the user a piece of information as a guideline to the general efforts of SEO was concluded to be important and was therefore present

in the requirements set out in section 6.1.1 (Prototype requirements). It was also noted that SEO technicians often look for detail during their work in order to answer specific questions. On the other hand, novices most often did not have complicated queries or desired detail but were driven mostly by their desire to get an overview. This was the clue that further aided the validity of the idea of providing an SEO status indicator. As mentioned previously, simplicity and minimalism has been a guiding factor of the design thus also indicating that an overview will be superior to details when considering the novice user. The combination of all this provided the first heuristic. By providing a general overview of SEO status the user can quickly answer vital questions regarding their website. If the status is positive the user can feel secure in the knowledge that all is well and if the status is negative the user is provided with options to get further details so he or she can start asking the right questions.

By stripping away a large portion of the data from the visualisations the user can focus on trends and getting an overview. As mentioned previously, the novice most often wishes to see just this. If the user on the other hand wishes to get more detail it is vital to provide options to access additional data. This was found when for example the table was removed that displayed the keyword rankings in a table. By removing the details the user could no longer get answers to more complicated queries, as was sometimes desired. As this discussion emerged the idea of augmenting the visualisations with interactions that would enable the user to access detailed information regarding the visualisations arose. This resulted in the second heuristic. As the design reaches its most minimal state in which the user can achieve the tasks of finding trends and getting an overview details must be provided in order to answer certain questions that can arise if the user wishes to understand why a graph is dipping or a partition of a donut graph is very large. Then, using interactions to augment these visualisations in order to bring forth critical data is crucial and adding validity to this heuristic.

As was noted by the users when using the table in the first prototype of the customer front page it did not provide the overview they desired. The table promoted details in depth and not an ability to get an overview of trends. Thus, this was changed to a graphical representation, a histogram. The histogram provided users with the overview they desired and needed in their work tasks. An important note is that the histogram is not by any means the one and only solution to this problem. What was noted was that a more general representation was necessary and the histogram was deemed and proven to be a good solution towards this end. Although true, this desire of the users (who are novices) remains, a graphical representation of the keyword rankings is necessary. Thus, resulting in the third heuristic. The graphical representation of keyword rankings promotes the concept of viewing trends, as discussed previously, which is the main objective the novice user wishes to achieve. However, this graphical representation must also be understandable by the novice. Using a complex multi-faceted graphical representation will not suit the novice user, even though it might promote the idea of viewing trends. The expert user might be able to comprehend and use the visualisation to its fullest but the novice will be unable to get an overview from the visualisation. This brings us to the notion

of complexity and how novices cope with it. This will be discussed in the following section.

As the system is to be used by novices who are not well versed in the world of SEO and its multi-faceted ways it is crucial to present data in such a way that the user will understand and be able to use it. Using complex terms as KRA (Keyword Rank Averages) or KUD (Keywords Up vs. Down) will not be understandable to the extent that the user feels comfortable about their true meaning. Also, using over detailed representations such as 'Two months ago' instead of 'April' will add unnecessary complexity to the design. Furthermore, presenting data in a clustered or cluttered fashion instead of breaking it apart into manageable chunks will also add complexity. Therefore, presenting a minimal and simple interface to the user has proven to be key. Thus, resulting in the fourth and final heuristic. Avoiding, complexity is perhaps the most general of the heuristics but it has proven to be vital in the design of this system. As with novices of any area, using complicated terms or visualisations will increase frustration and the usability of the system will be reduced. Therefore, using representations that suit the novice is important. For example, when presenting the amount of top thirty keywords to the user there is a difference between presenting the data as '25 keywords' instead of '25 keywords in the top 30'. By providing the user with a more descriptive representation the understandability increases. The room for error or misinterpretation has been lowered greatly with this small change of wording. Therefore, complexity is an important facet of these types of interfaces when targeted at novices.

In the following section the validity of these heuristics will be further established through the results of the user study described in the previous chapter.

## 8.2 Evaluation

As seen by the test results of task 3 in table 7.1 the act of finding the SEO status of a website is a fast, error free and pleasurable experience. Users were able to quickly get an accurate overview of how well their SEO efforts are proceeding. This attributes to using a graphical visualisation that summarizes a large set of data, simplifies it and provides it to the user in an understandable fashion. By using a graphical representation such as donut graphs instead of a detailed representation such as a table the efficiency of getting an overview of SEO status has been greatly improved. Thus, further establishing the validity of the first heuristic.

Tasks 2, 4, 8 and 10 demand interactions by the user in order to be completed. These tasks produced lacklustre results in terms of efficiency however this was due to aspects of the design and not its interactive abilities. The interactions provided efficient means of accessing information and it is not to blame for the poor results of these tasks. By stripping away detail to provide minimalism interactions provide a good way of accessing additional information. As noted by the users throughout the testing phase, irritations were with the design during a set of tasks and not the interactions. Interactions proved viable means of accessing information and

without having moved detail to the interactions several other tasks would have greatly increased in time, errors and decreased in user experience. The combination of these discussions provides further validity and strengthens the foundation upon which the second heuristic stands.

By using a histogram to provide a graphical representation of keyword rankings task 1 was fast, almost error free and highly appreciated in terms of user experience. The primary task users often perform is see how many keywords lie within a certain interval in order to get an overview of where the largest portion of their keywords lie in terms of ranking. Thus, task 1 is a good measurement of this task. When using a table in order to get an overview the time it takes to perform the task is greatly increased, also this method is more error prone as it is not as clear as to where the selection might end or begin. Thus, by providing the user with a graphical representation of keyword rankings a primary task has been simplified and made into a pleasurable experience. This further validates the third heuristic.

The averages of the individual aspects (time, errors and user experience) suggested that the design was fast, fairly error free and provided a pleasant working experience. This can be some what attributed to the fact that complexity is avoided. If complexity was introduced these scores would be affected and almost certainly this effect would be negative. By reducing complexity in all parts of the design and its interactions the overall scoring of the design has proven to be good. The test results shown in table 7.1 and the discussion in this paragraph further establishes the validity of the fourth and final heuristic

# 9

## Results

*"However beautiful the strategy, you should occasionally look at the results."*

- Winston Churchill

This thesis work has resulted in an SEO tool which visualises information to the novice user regarding the SEO efforts concerning their website. In order to arrive at the resulting design several cooperative iterations of prototyping and design have been conducted with novices and experts in order to achieve a suitable design.

### 9.1 Final design

The tool has resulted in two separate views: the first focusing on general information and domain information, the second containing more specific keyword information. The design is minimalistic and uses interactions in order to bring forth detail. The final design can be found in Appendix B. The view containing the general and domain specific information can be seen in figure B.1. The design provides the user with an overview and trend analysis tools instead of detail. Details are provided through interactions such as hovering.

A table was used in the view which shows keyword information in order to provide more explicit detail, as suggested by users. This table provides three forms of interactions which provides the user with modals consisting of further information. These interactions provide: the keyword's search result, search volume for the keyword and competition analysis for the keyword. These visualisations can be seen in figure B.2, B.3, B.4 and B.5.

### 9.2 User study

A comprehensive user study was conducted which suggested the resulting design's effectiveness. Ten tasks were selected to be the most commonly executed and these were tested in six user groups consisting of five test subjects each. The aspects that were tested were time to completion, number of errors and user experience.

After the testing was completed the results were averaged and mean values were calculated. These were then compared against a table containing the requirements of the design which had been developed by experts within SEO and myself. The test results suggested that the final design was both efficient and satisfactory.

### 9.3 Heuristics

An analysis of the final design and its facets has resulted in four heuristics which provide key insights into aspects of designing SEO visualisations for novices.

1. Use graphical visualisations to display generalised SERP data e.g. amount of Top 30 keywords, Keyword Rank Averages or Keywords Up vs. Down.
2. Provide interactions in order to bring forth detail, for example providing tooltips on data points in a line graph.
3. Use graphical visualisation(s) to present keyword rankings (SERP data) in e.g. a histogram.
4. Avoid the use of complex terms, expressions, notions or representations.

These heuristics were established through discussions regarding concepts and ideas that emerged during the prototyping and design phases. Furthermore, the user study and its results have been used to further establish the validity of the heuristics.

# 10

## Discussion

*"Discussion is an exchange of knowledge; an argument an exchange of ignorance."*

- Robert Quillen

This chapter will seek to discuss various aspects of this thesis work. The method, results, validity, ethical issues and future work will be explored and further examined.

### 10.1 Method

As mentioned in chapter 4 (Methodology) several methods have been used. Agile development was used during software development, participatory design was used to activate the user in the design process using several methods. Also, UCD was used as a guiding design process also aiming to involve the user. Lastly, several methods were used in order to gather data about users and their behaviour.

Agile development is a method I have used before in many projects both alone and in group. Thus, this method was the obvious choice for me during the software development process. Working agile allowed me to plan and focus the work that needed to be done in a controlled fashion. Also, using sprints/iterations tied well into the prototyping and design phases which also were built up of iterations.

Participatory design has been a leading activity throughout this thesis work. As the design is meant to be used by novices activating these users in the design process allowed for further insights into their work process, mental models and daily lives. Furthermore, including the novice in the design in for example cooperative prototyping or workshops allowed for the user to create a sense of ownership over the end product. As they have been part of the development process and have contributed to the product in their own ways they now feel more inclined toward using it. However, by involving the user so deeply reduces the amount of actual design work that can be done. Design work was to some extent exchanged for discussions. Leaving me with the impression of that more could be done. By involving the user in almost all steps of the process there was a notable reduction in the work I was able to do. Although this is true, I do not believe it has affected the effectiveness of

the final design. These discussions were necessary in understanding the user and any amount of extra design work I could have done would probably not trump this.

Tying into participatory design, as mentioned in the previous section, UCD was used as the guiding design process throughout this thesis. UCD was seen as the theoretical framework in which the participatory design, ethnography and workshops were conducted. By using UCD as a framework for reference and as a theoretical backbone of involving the user I could achieve greater results while involving the user.

The chosen methods - Interviews, Observations and Screen Capturing - allowed for a great way of accessing data. By combining these methods a large variety of analysis were able to be conducted. Observations and Screen capturing allowed for good ethnographical data to be discovered while interviews allowed me to access more structured information necessary to form opinions or draw conclusions. Although positive in many regards, Screen capturing provided one facet that was not anticipated. Due to certain ethical issues I always alerted the user before they started the tasks that they would be recorded. All agreed to this but I got the feeling that a subset of the subjects altered their approach to the system whilst being recorded. They spoke less, made fewer facial expressions and were more frustrated when they got something wrong. These tests were not used in the final user study due to these facets. They are however interesting and perhaps I shall venture into researching this phenomenon in the future.

## 10.2 Results

The results of this thesis have been both surprising and anticipated. The fact that a minimal and simple design emerged as the final design was not surprising. As the system is intended for novices it has turned out to be obvious that such a system would indeed surpass a complicated one.

On the other hand I was certain that I would be able to find and define more heuristics than the four explored in this thesis. I am not disappointed, only surprised that this was the result. I was anticipating that I would be able to, through the prototyping and design phase, locate several aspects that would define necessary values that would permeate the final design. Although true, I did not locate as many as I had anticipated. I think this is because many of the aspects I uncovered throughout my search for heuristics were very general and could be applied to almost any representation visualising information. As this was the case I opted out of further researching these values in favor of the more specific ones I finally chose to include in this thesis.

The user study explored in chapter 7 contained certain facets that were also both surprising and anticipated. It became clear that users performed certain tasks just as I had envisioned and planned for them to be executed. On the other hand, during certain tasks the user's misinterpreted the design and therefore had difficulties

performing the given task. As I mentioned in section 7.3 there was a task that the users got 'wrong' especially frequent. The user had gotten used to a certain interaction to retrieve information so they missed another part of information that was located elsewhere. This was surprising to me. As an engineer and designer I have a certain way of scanning over an interface in order to locate what I am searching for. It was noted that many people do not have this logical approach to using an interface. Once the user had gotten used to a certain interaction or design element they became so used to it that they missed other pieces of information that would have enabled them to perform their given task more efficiently. This is another aspect I might explore further in the future.

### 10.3 Generalisability

As noted in the previous section there were several heuristics that I opted out of investigating further due to them being too general and could be applied to many different visualisations. This has been an aspect throughout the entire design. I wanted to analyse a certain subset of visualisations, SEO visualisations. And this limited the scope and generalisability of this thesis work. However, much of the work and discussions present within this thesis does carry some generalizability. The discussions regarding prototyping, graphical design and interaction design throughout chapter 6 especially.

Also, adding further visualisations and data into the system would be possible. The system is modular to a great extent and creating further views is an available option. Furthermore, the resulting visualisations are well tested and have received many iterations in order to refine them. Thus, they could be generalised and used in other scenarios. The combination of donut graphs and histogram could be used to display a wide variety of combinations of data sets where the donut graphs provide a more general overview and the histogram adds detail. For example, demographic data such as visualising people above and below a certain age and living within and outside of a certain country. The histogram could then display all persons within their age spans. Due to the visualisation's well tested and reviewed nature there are a wide variety of uses for the them.

### 10.4 Future Work

Although I am pleased with the outcome of this thesis work and its results there is some work I wish to continue some day.

A longer user study conducted during live use of the system would be beneficial in establishing its validity and usefulness. The user study was conducted in a controlled environment and performing a longer user study set in the 'real' world could provide further information regarding the efficiency of the system. Also, there is further

work to be done with the development of heuristics. Due to the time span of this thesis I focused on a limited set of heuristics and in the future I should like to conduct further work in researching other heuristics regarding this system.

Adding more visualisations and data to the system is also part of the future work. The visualisations added in the system provide a basic set of SEO information to the user in order to conduct their work. By providing further visualisations a more specialised tool can be created. By analysing the system further in the aforementioned user study could give valuable insight into possible additions to the system.

# 11

## Conclusions

*"It's time to say goodbye, but I think goodbyes are sad and I'd much rather say hello. Hello to a new adventure."*

- Ernie Harwell

In the beginning of this thesis work I had the idea of there being heuristics regarding the design of SEO visualisations for novice users. I have, through various methods, created such a system and explored heuristics regarding its design. Furthermore, a user study was conducted in order to validate the design and the heuristics. This thesis has resulted in a set of four heuristics which can be used when developing similar systems. The final design is minimalistic and focuses on providing an overview to the user and embedding details within interactions. These were found to be the aspects of the system proposed by the heuristics.

The functionality of the system complies with the requirements set out at and a detailed user study suggests that it is efficient. A set of heuristics have been established which have been validated using the results of the user study.

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# A

## Interview questions

The following questions were used during the prototype and design phases in order to create a base for discussion that was used to evaluate the prototypes and designs during the design process.

1. Do you understand the meaning of the prototype/design?
2. Are you able to get a good overview of the current prototype/design?
3. Is the prototype/design aesthetically pleasing?
4. Are there superfluous elements in the prototype/design?
5. Are there elements you wish were present in the prototype/design?
6. Are there interactive elements in the prototype/design?
7. Are the interactions pleasing to use?

# B

## Final Design

Within this Appendix lies the final design of the proposed tool.

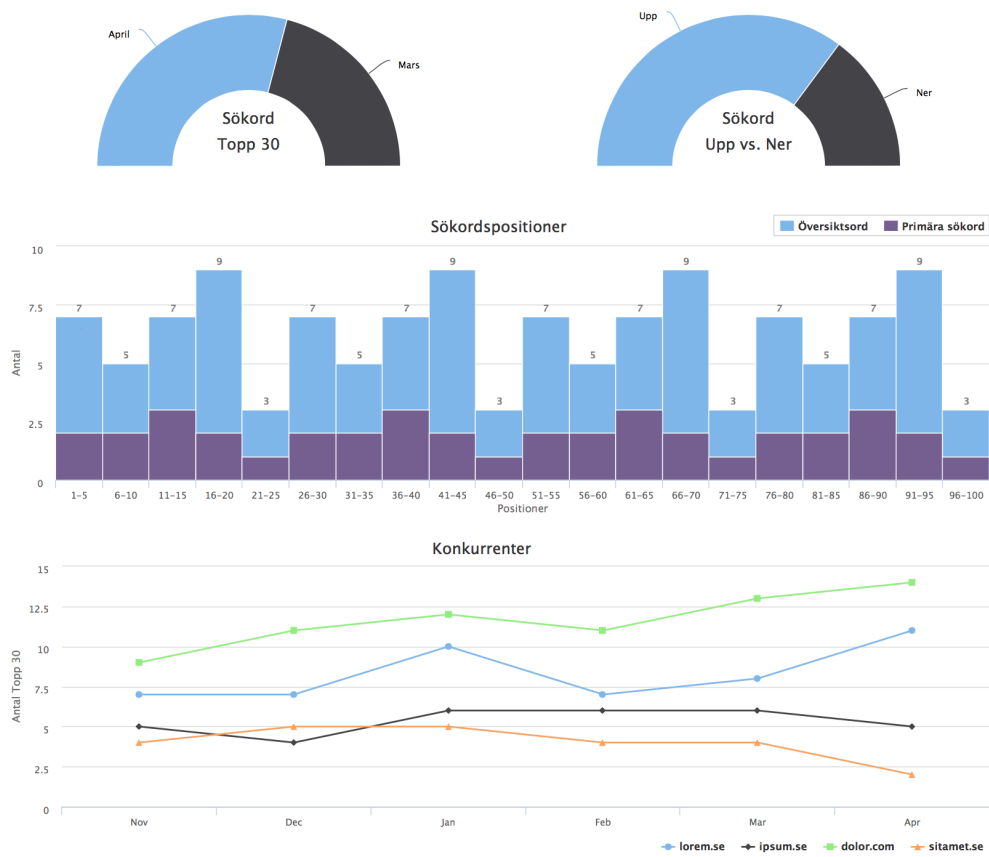


Figure B.1: Final design of the general and domain specific visualisations.

Sökord	Språk	Position	Förändring	Globala sökningar	Lokala sökningar	
Bilskola	Svenska	2	2 ▲	12 000	7 000	Detaljer
Bilskola	Svenska	2	2 ▲	12 000	7 000	
Bilskola	Svenska	2	2 ▼	12 000	7 000	
Bilskola	Svenska	2	2 ▲	12 000	7 000	
Bilskola	Svenska	2	2 ▼	12 000	7 000	
Bilskola	Svenska	2	2 ▲	12 000	7 000	
Bilskola	Svenska	2	2 ▼	12 000	7 000	
Bilskola	Svenska	2	2 ▲	12 000	7 000	

Figure B.2: Table displaying its three actions.

The screenshot shows a search results page for the keyword 'Bilskola'. A modal window titled 'Sökordsinformation' is open, displaying search results. The modal content includes:

- Ditt resultat**
- Körkort & Trafikskola i Eskilstuna, Västerås och Köping**
- [www.axts.se/](http://www.axts.se/)
- AXTS i Eskilstuna · AXTS i Köping · AXTS i Västerås · Blanketter · Företaget ... YKB
- GRUND · Kursdatum se - Kurskalender - ny adress Munkbov. 7, Hacksla ...

The modal also features a 'Stäng' (Close) button. In the background, a table shows search results for 'Bilskola' in Swedish, with columns for 'Sökord', 'Språk', 'Position', 'Förändring', 'Globala sökningar', and 'Lokala sökningar'. A 'Detaljer' button is visible next to the first row of the table.

Figure B.3: Modal displaying a keyword's search result.

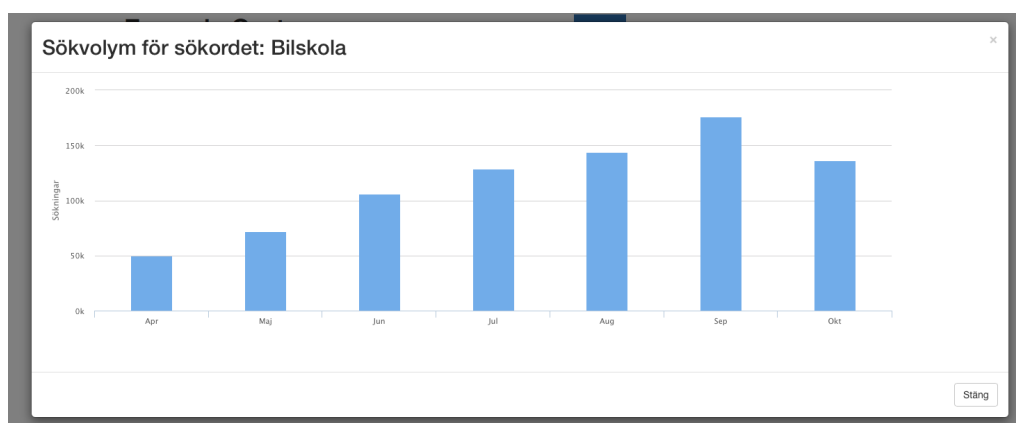


Figure B.4: Modal displaying a keyword's search volume.

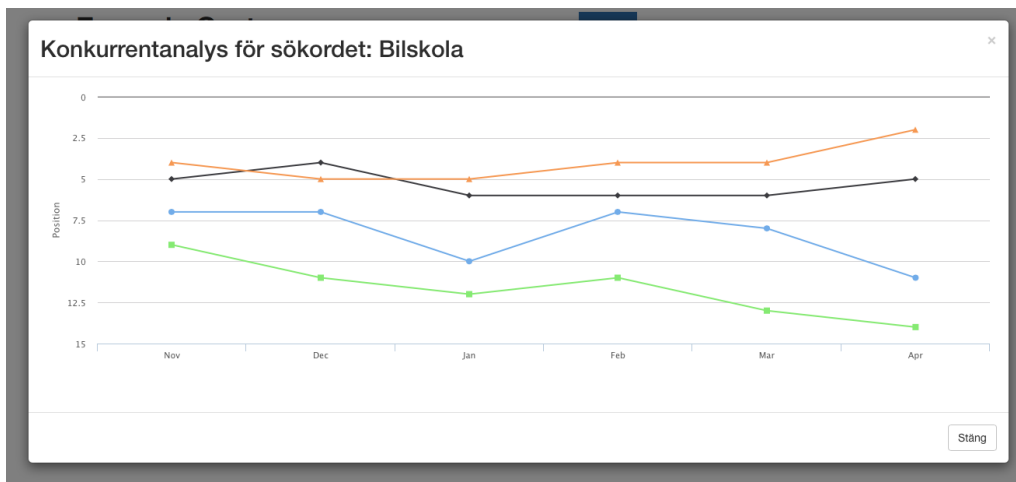


Figure B.5: Modal displaying the keyword's competition.