Abstract

Web site usability is an important factor when creating and managing web sites, since it essentially determines whether or not the site is usable by its intended audience. As an attempt to simplify the process of achieving high usability for web sites, this thesis has explored the possibility of integrating usability guidelines with web content management systems. The overall aim was to determine if, and how, usability guidelines can be implemented in a web content management system to make it promote and deliver web site usability, and to find solutions that aid web site users in carrying out the basic tasks of finding, reading and understanding information on the web. To estimate the effectiveness of such solutions, the level of human dependency was considered when evaluating the solutions. This thesis has shown that it is possible to construct such solutions, and has found several for each of the basic user tasks of finding, reading and understanding information. Although some of the found solutions automatically improve a site’s usability or actively promote site usability, the majority are still dependent on human efforts in order to promote usability. It was concluded that it is possible to integrate usability guidelines with a web content management system, but that web site usability still largely depends on human effort in order to be effective.

Keywords: Web usability, Human-Computer Interaction, Web Content Management Systems, Web development.
# Table of contents

Abstract.................................................................................................................................ii

Table of contents...................................................................................................................iii

Terminology............................................................................................................................v

1 Introduction..............................................................................................................................1
   1.1 Background and problem motivation.................................................................1
   1.2 Overall aim.............................................................................................................1
   1.3 Scope.......................................................................................................................2
   1.4 Low level problem statement.............................................................................2
   1.5 Outline.......................................................................................................................2

2 Theory..........................................................................................................................................3
   2.1 Web Content Management Systems.................................................................3
   2.2 Hypertext Markup Language..............................................................................3
   2.3 Cascading Style Sheets.......................................................................................3
   2.4 How users find sites and what they find...........................................................4
   2.5 Satisficing...............................................................................................................4
   2.6 Information foraging.............................................................................................4
   2.7 Search engine optimization..................................................................................5
   2.8 Site Navigation........................................................................................................6
   2.9 Labeling information............................................................................................7
   2.10 How and what users read....................................................................................7
   2.11 Accessibility...........................................................................................................8

3 Methodology............................................................................................................................9
   3.1 Initial literary study.................................................................................................9
   3.2 Solution approach.....................................................................................................9
   3.3 Evaluation................................................................................................................10

4 Solution...................................................................................................................................11
   4.1 Finding a site............................................................................................................11
      4.1.1 Analysis...........................................................................................................11
      4.1.2 Solutions.........................................................................................................12
   4.2 Finding within a site...............................................................................................17
      4.2.1 Analysis...........................................................................................................17
      4.2.2 Solutions.........................................................................................................18
   4.3 Reading and understanding site content.............................................................22
      4.3.1 Task analysis...................................................................................................22
# Table of contents

4.3.2 Solutions ........................................................................................................... 23

5 Results .................................................................................................................... 27
  5.1 Evaluation result .................................................................................................. 27
  5.2 Result distribution .............................................................................................. 28

6 Discussion .............................................................................................................. 30
  6.1 Evaluation result ................................................................................................ 30
  6.2 Future work ........................................................................................................ 32
  6.3 Final remarks .................................................................................................... 32

References .................................................................................................................. 33
Terminology

Acronyms

ATAG Authoring Tool Accessibility Guidelines
CMS (Web) Content Management System
CSS Cascading Style Sheets
HTML Hypertext Markup Language
HTTP Hypertext Transfer Protocol
SEO Search Engine Optimization
SERP Search Engine Result Page
URL Uniform Resource Locator
W3C World Wide Web Consortium
WAI Web Accessibility Initiative
WCAG Web Content Accessibility Guidelines
WYSIWYG What You See Is What You Get
XHTML Extensible Hypertext Markup Language
1 Introduction

This thesis explores the possibility of integrating web usability guidelines with web content management systems (CMS) in order to produce web sites with high usability "out of the box". The hope is that by making usability engineering less of a manual task by integrating it with a CMS, it will be utilized more frequently and thereby lead to more web sites having high usability.

My education is 150 higher education credits of which 82.5 of those credits are in computer engineering, mostly related to web development technologies.

1.1 Background and problem motivation

Web site usability is an important factor when creating and managing web sites, since it essentially determines whether or not the site is usable by its intended audience. While a site with high usability may provide good value for its visitors, a site with major usability issues might cause sufficient irritation for its users to make them leave and never come back. However, web usability is a broad discipline that runs across several other professions and involves almost every part of a web site. Larger web site projects may very well include usability engineers as well as experts for some of the cross disciplines of web usability, but smaller projects will probably consist exclusively of developers and designers, or perhaps only a single developer or designer. Many web sites exist at the present time which are confusing and difficult to use, and the obvious conclusion to be drawn from this is that web site usability is an overlooked subject. As an attempt to simplify the process of making a web site usable, this thesis explores the possibility of integrating usability guidelines with a CMS.

1.2 Overall aim

Web usability is a broad discipline and sources of usability problems can be sorted into an almost limitless number of areas. In order to find an effective approach for implementing guidelines in a CMS, a certain amount of prioritizing regarding usability areas is required. Solutions should target the usability issues that have proved to be the most problematic for the users.
The overall aim for this thesis is therefore to determine if, and how, usability guidelines can be implemented in a CMS to make it promote and deliver web site usability, and also to find solutions that aid web site users in carrying out the basic tasks of finding, reading and understanding information.

1.3 Scope

The scope of this thesis is limited by the functionality that a CMS is commonly assumed to provide, since these assumptions essentially determine whether a specific usability guideline generally applies to a CMS. In order to simplify the process of finding solutions that clearly apply to a CMS, the areas that are strictly related to presentation – such as graphic design, layout, colors and typography – are not targeted by this thesis.

1.4 Low level problem statement

In addition to determining whether integrating usability guidelines with a CMS is possible, the level of integration of such solutions should also be considered in order to provide an estimate of the effectiveness of the solution. This thesis therefore aims to answer the following questions:

1. Can solutions be found that enable a CMS to prevent common usability problems from occurring?

2. If such solutions can be found:

   a) Can such solutions automatically improve site usability?
   b) Can such solutions actively promote usability within a CMS?
   c) Can such solutions provide tools for improving site usability?
   d) Can such solutions provide instructions for improving site usability?
1.5 Outline

Chapter 1 introduces the project and describes the goals and problems faced by this thesis. Chapter 2 presents the theory that this thesis is based on. Chapter 3 describes the methodology used by this project to find relevant theory, to form solutions and to evaluate those solutions. Chapter 4 contains the analysis and solution descriptions for the main areas covered by this thesis. Chapter 5 presents the results of the solution evaluations and chapter 6 provides a discussion about the project and the conclusions drawn. The thesis ends with a list of the references used.
2 Theory

Chapter 2 presents the background material and theory required in order to provide a better understanding in relation to this thesis. A brief description is firstly provided as to what a web content management system is and what it can be assumed to feature, followed by a short description of some basic web technologies. Following that is a brief explanation of user behavior models and theories, and finally the theory for usability areas discussed is presented.

2.1 Web Content Management Systems

A web content management system (CMS) is a web based system whose primary purpose is to allow users with little knowledge of web technologies such as markup and programming languages to easily create and manage content for web publishing. Common traits are web based administration interfaces, content being separated from presentation for ease of editing, and "What You See Is What You Get" (WYSIWYG) tools for editing content. It is also relatively common to require a web developer to set up the systems and manage their technical features. [1]

2.2 Hypertext Markup Language

Hypertext markup language (HTML) is a core technology for building web documents. It is a markup language, and uses tags to describe content within web documents. The tags provide semantics for their content which enables headings, paragraphs, lists etc to be interpreted as such. Since the primary purpose of HTML is structuring information, graphical presentation of HTML documents should be performed using Cascading Style Sheets (CSS). [2]

2.3 Cascading Style Sheets

CSS is commonly used alongside HTML to apply graphical presentation to HTML documents. Separating structure and presentation in this way has many benefits, such as improving content accessibility, allowing shared presentation among different documents and allowing different presentations for the same document. [3]
2.4 How users find sites and what they find

The majority of users surfing the web use search engines to find sites that meet their requirements (88%). Very few look beyond the first search engine result page (SERP) (7%), and half (53%) do not even scroll down on the first SERP. [4]

To exemplify these statistics, consider a hundred people searching for information on the web. Out of these hundred:

- 12 went to a site they already knew
- 88 consulted a search engine
  - 6 people looked beyond the first SERP
  - 82 people only viewed the first SERP
    - 35 people scrolled the first SERP
    - 47 people only viewed the top 5 results

Less than half of all users enter a site through the home page (40%) [4], which also means that the majority of users (60%) bypass the home page when visiting a site.

2.5 Satisficing

Satisficing is a term created by combining the words "satisfy" and "suffice", and describes a strategy of decision making. Its key suggestion is that someone facing a choice will most likely choose the first reasonable option. Since web users tend to be in a hurry and due to the low penalty of clicking the wrong link, it is thus an effective means of finding information on the web. [5]
2.6 **Information foraging**

Information foraging is a theory that describes how users gather information on the web. It uses hunting animals as an analogy to describe the behavior of users browsing the web, and the key point is that a user will try to gain as much as possible with as little effort as possible. Decision making when navigating a site is assumed to be dependent on two estimates: the value of the information and the cost of obtaining it. Information foraging theory also predicts that people will spend less time on any one site, because search engines make it easier to find other qualitative sites. Because of this, supporting short visits and having good organic search engine rankings becomes more important, as well as the search results reflecting users' immediate needs. [4]

2.7 **Search engine optimization**

Search engine optimization (SEO) is essentially a collection of techniques that can be used to improve a site’s search engine ranking. There are three main approaches of SEO:

- Linguistic SEO
- Architectural SEO
- Reputation SEO

Linguistic SEO targets the use and placement of keywords in titles, headings and content. Using a specific keyword in the page title would indicate to search engine crawlers that the word is relevant for the main purpose of the page, and would lead to a higher ranking for that specific keyword.
Architectural SEO includes making sure that indexing the site is possible, and that the link structure corresponds to each page's importance within the site. Making a site indexable is accomplished mainly by ensuring that there are links to all pages that should be indexed, that pages have a textual uniform resource locator (URL), that important content is available as text and that semantic markup is used so that the search engine can extract and determine the linguistic meaning of the text. To determine the importance of a page within a site, a search engine counts the number of incoming links and compares that figure to the other pages in the site. By linking more frequently to important pages within the site, those pages become marked as more important and receive higher search engine rankings.

Reputation SEO is accomplished by having many incoming links from other sites. In addition to having a qualitative site that is worth linking to, assistance to this process involves having short URLs and by persistently maintaining URLs over time. [4]

2.8 Site Navigation

Navigation systems within a site can usually be divided into two categories: embedded and supplementary. [6]

Embedded navigation is usually organized hierarchically and is commonly presented as global, local and contextual. Global navigation is intended to be consistent throughout a site and commonly includes links to its major areas, a link to the home page and also to supplementary navigation such as the search function. Local navigation is used to enable navigation within a specific area of the site, and can either be integrated with the global navigation or presented separately. Contextual navigation appears in the actual content area and is commonly used to link to related content. [6]
Supplementary navigation includes site maps, site indexes and internal search. A site map acts as a table of contents, and is commonly used for displaying hierarchically organized information. Its main purpose is to display the site's structure and supply fast access to all important content. A site index is usually alphabetical, and provides a non-hierarchical alternative to finding content. An internal search allows users to enter search terms themselves, and thus enables searching for very specific content. [6]

Each type of navigation has its own benefits, and by featuring multiple ways of finding content this assists in compensating for the differences in perspective of the users. Navigation that employs ambiguous organization schemes (ambiguous because of the nature of human language), such as embedded navigation and site maps, is effective when users have limited knowledge of their exact requirements. Navigation based on exact organization schemes (alphabetical, chronological etc), such as site indexes, is more effective when a user knows precisely what to look for. [6]

Navigation also includes providing users with their current location within the site. This is usually accomplished by having a "you are here" text and by providing a visual cue in the embedded navigation, but can also be accomplished by providing a breadcrumb trail that shows the current position of the users within the site as well as the upper levels of the hierarchy from that position [5]. According to Nielsen and Loranger [4] and Morville and Rosenfeld [6], providing color coded links to indicate whether or not the link has been visited is also a feature that assists users to orient themselves within a site [4].

Additionally, a web browser usually also features navigational tools. These include the address field which allows direct access to any web page, the back and forward buttons to move through already visited pages, the history log which allows quick access to any previously visited page, and bookmarks that allow users to create shortcuts to pages they would like to revisit. These are features that should always be supported, since breaking or bypassing them can create severe usability problems. [6]
2.9 Labeling information

Labeling is how words are used to represent a larger group of information, and this is highly related to web site navigation as well as writing good web content. Common labels on a site are links, both as part of a navigational system and contextual links, headings and terms used in site indexes. In a navigational system a category should represent the underlying content of that particular category, in contextual links the link text should represent the content that the link leads to, a heading should represent the text that follows it and index terms should describe its grouped resources. In order for a label to effectively communicate its content, it must be short, descriptive and consistently used. [6]

2.10 How and what users read

Users usually arrive at a site with the goal of finding a specific chunk of information. When this is the case, that user will scan the page for information or links that appear to be relevant to achieving the goal. This means that a user is likely to read only a small part of the text presented on any web page, but how much a user will actually read varies with how specific the goal is. If a user has a very specific goal, only text that appears to be directly related to the goal will be read. If however the goal is to gather general information about a certain subject, a user might first scan for relevant information and then read that information in greater detail. [4]

This behavior is explained in more detail by information foraging theory. However, the essence is that users are usually in a hurry when reading and know that reading every piece of information is not necessary [5].

2.11 Accessibility

Users also have different basic conditions when visiting a site. Factors such as browsers, screens, screen resolutions and a user’s eye sight should always be considered when designing sites, in order to make it accessible for as many users as possible. [4]
The World Wide Web Consortium (W3C) is an organization that focuses on making the web accessible for everyone [7]. Their project called the Web Accessibility Initiative (WAI) provides guidelines and techniques for producing accessible web content [8]. There are two specific sets of guidelines that relate closely to what a CMS should provide and produce in form of accessibility: the Web Content Accessibility Guidelines (WCAG) [9] and the Authoring Tool Accessibility Guidelines (ATAG) [10]. In addition, the HTML specification [11] and the extensible HTML (XHTML) specification [12] are good for ensuring that markup elements are used properly.
3 Methodology

Chapter 3 presents the methodology used for this project and starts with a description of the initial literary study, followed by the solution approach and the method of evaluation.

3.1 Initial literary study

In order to find a good approach for solving common and severe usability problems, some literary studies will be initially required. The literature chosen for this study is:

- Don't Make Me Think (2006) by Steve Krug
- Prioritizing Web Usability (2006) by Jakob Nielsen and Hoa Loranger
- Information Architecture for the World Wide Web (2007) by Peter Morville and Louis Rosenfeld

This literature was chosen in order to provide an overall orientation of common usability problems, as well as to provide in-depth knowledge of areas closely related to web content management. Since the literature chosen is based on empirical observations and extensive research, it can be considered as being a reliable source.

3.2 Solution approach

After conducting the initial literary study, the information gathered will be used as a guide for discovering appropriate areas for which solutions can be constructed and also as the theoretical foundation for solutions. Additional gathering of information in order to provide the motivation to pursue particular solutions is also expected to be necessary. In order for a solution to be considered as a valid solution, the following criteria will be used:

- It should be supported by theory
- It should apply to a CMS
- It should be implementable using existing technologies
It should be noted that the practical efficiency of the solutions will not be considered. Based on the variations of human behavior, a general usability guideline is valid in relation to approximately 90% of all cases, and site specific user testing is usually required in order to accurately determine the actual efficiency of such a guideline [4]. Since the solutions in this thesis should aim to be as general as possible, disregarding practical efficiency should not significantly affect the reliability of the solutions.

3.3 Evaluation

In order to determine the level of integration for a solution, a means of measuring human dependency in relation to a solution will be required. A fully integrated solution will be assumed to require no deliberate human efforts, while a solution with low integration is assumed to be highly dependent on human efforts. The following criteria, presented in descending level of integration, will be used to evaluate the solutions suggested by this thesis:

- **The solution automatically improves usability**
  The solution improves usability with no human effort required.

- **The solution actively promotes usability**
  The solution actively provides feedback to CMS users regarding how to improve usability. The solution is responsible for determining whether there are usability issues, although the user is still responsible for following the feedback provided.

- **The solution provides tools for improving usability**
  The solution is a tool that improves usability. The tool relieves CMS users of some responsibility, although the tool must be used – and used correctly – in order to be effective.

- **The solution provides instructions for improving usability**
  The solution provides instructions for improving usability. The responsibility for improving usability, and determining whether usability issues exist, is thus greatly dependent on CMS users.
Chapter 4 presents solutions to common problems within each of the user tasks specified in the low level problem statement. Some changes to the grouping of user tasks has been made in order to gain a more balanced approach. The task of finding information is divided into two separate areas: finding a site and finding within a site. Furthermore, the tasks of reading and understanding information are combined into a single area.

For each of these areas a short analysis of the theory is presented in order to identify common problems and to find a good approach for providing solutions, followed by the actual solutions.

Some of the suggested solutions appear more than once in this chapter. This is because each sub-chapter treats a separate set of issues, and since a solution may apply to more than one set of issues they are treated as separate solutions.

### 4.1 Finding a site

The task of finding a site includes how users look for information on the web and what they find when looking. Although not strictly related to web site usability, this step in finding information is crucial for most sites due to the fact that people are using search engines as their primary means of finding information on the web.

#### 4.1.1 Analysis

Since the vast majority of users find sites by consulting search engines – and that a large number of those users only look at the first 10 results at most – implementing SEO techniques should be a top priority for a CMS.

It is also worth mentioning that each SEO technique will most probably produce different results. Employing architectural SEO should be a priority since it essentially enables sites to be indexed, and also ensures that important pages become prioritized. Although the other two techniques depend on proper architecture, they should still be taken into consideration since they are the means by which relevance is built for certain keywords.
What people find when searching should also be considered. A site’s home page is the starting point for almost half of all users, which should be sufficient indication with regards to the importance of having a good home page. However, the other users enter through some other page on the site, which indicates that it is almost as important to have a good home page as it is to support visitors who enter site by bypassing the home page.

In addition, information foraging theory states that users will spend less time on any individual site as search engines improve the general relevancy of their search results, since users will find pages that contain exactly what they want more often. Since user behavior appears to progress toward entering sites through pages other than the home page, this behavior should definitely be supported. Taking measures to improve general SEO would enable there to be better indexing of the site and also to make individual pieces of information appear more frequently in SERPs.

There are also other steps in supporting deep-link visitors, but since these are closely related to finding information within a site they will be, instead, discussed in chapter 4.2.

**4.1.2 Solutions**

This part of the chapter presents possible solutions to the facts and issues discussed in chapter 4.1.1.

**4.1.2.1 Producing semantic markup**

Producing semantic markup can be seen as a step in implementing architectural SEO. By generating semantic markup a CMS can make it easier for machines to understand the meaning of a certain text as well as pointing out the overall structure of the document. This also contributes to enhancing a site’s accessibility, since many browsing tools for the visually impaired use the same techniques as crawlers.

Consider an article consisting of a heading and text. Figure 1.a shows such an article represented with non-semantic HTML, while Figure 1.b shows the same kind of article using semantic HTML. The first article uses `<div>`-elements to mark up the heading as well as the text, using only the `class`-attribute to differentiate them. It also makes use of the
<b>-element to mark that the word "not" should be boldfaced, and <br>-elements are used to indicate line feeds. The second article uses the <h1>-element for the heading, <p>-elements to indicate that the text consists of two paragraphs, and a <strong>-element to indicate that strong emphasis should be placed on the word "should". Both articles could be made to appear the same in a browser using CSS, but if viewed by a crawler the first article would merely appear as a block of text while the second one would provide meaning through a recognizable title, denoted paragraphs and an emphasized word.

```
<div class="heading">This is an example</div>
<div class="text">This is an overly clear example of how<br>not to write semantically.<br>End of example.</div>
```

*Figure 1.a: An article represented with non-semantic markup.*

```
<h1>This is an example</h1>
<p>This is how markup <strong>should</strong> be used to provide meaning.</p>
<p>End of example.</p>
```

*Figure 1.b: An article represented with semantic markup.*

Since a CMS can hide markup from authors in order to make it easier in relation to published content on the web, this should be able to be handled by a CMS without the involvement of content authors.

The HTML and XHTML standard specification and accessibility guidelines provided by W3C are good tools for ensuring that generated HTML is semantic.

### 4.1.2.2 Enabling text equivalents for non-textual content

Crawlers only index textual content, so it is important to provide text equivalents for non-textual content in order to make it indexable. This also helps to improve a site’s accessibility.
A good example would be an image and its `alt`-attribute. Consider a logo on a site. If it has no `alt`-attribute (or if the attribute has no value) it will be ignored by a crawler. If it were to have "logo" as the attribute value it would be recognized as "logo", which is very generic and cannot be considered as being a good equivalent of the logo itself. A good text equivalent would instead be what the logo represents, such as a company name or a specific product.

A CMS could aid this by providing an input field for entering text equivalents when publishing non-textual content such as images and multimedia.

4.1.2.3 Providing guidelines for writing good text equivalents

Since the effectiveness of text equivalents is highly dependent on the quality of the equivalent rather than its presence, simple guidelines regarding how to write good text equivalents could be included.

4.1.2.4 Featuring automatic creation of site maps and breadcrumbs

Both site maps and breadcrumbs can be considered as parts of the architectural SEO. A site map provides links to all important parts of a web site, so they are effective for guiding crawlers to content. It is also a good means of guiding users, since it can act as supplementary navigation by providing an overview of the site’s content. Breadcrumbs are good for showing a user's current position within the site and also for providing hints in relation to the site's information structure. Additionally, it is also good for reinforcing information hierarchies since it provides links back to the parent pages.

A CMS is most likely to have all the information about a site's content structure necessary to automatically create site maps and breadcrumbs. Featuring these functions could prove to be an effective means of improving overall architectural SEO.
### 4.1.2.5 Using textual URLs

There are several reasons for avoiding URLs with query strings (Figure 2.a) and instead using textual URLs (Figure 2.b). First of all, search engines do not index pages that appear to have been created dynamically, and the use of query strings are considered as an indication of dynamically created pages. Using textual links also makes the site less dependent on underlying technologies, which would allow for the switching of technologies while still using the same URLs. Since it enables more persistent links, and also leads to more readable and memorable URLs, it should be considered an important part of reputation SEO as well as in architectural SEO.

![Figure 2.a: A URL containing a query string.](http://example.com/index.php?lang=en&section=home)

![Figure 2.b: A textual version of the same URL.](http://example.com/en/home)

A CMS could utilize a URL by rewriting in order to translate textual links into query strings for use by systems. This in combination with pages having access names (such as "home") would allow textual links to be used for almost all pages that are to be indexed by search engines. As an example, rewriting the URL shown in Figure 2.a to the one shown in Figure 2.b on an Apache web server, could be accomplished by placing the code shown in Figure 2.c in a .htaccess document in the root folder of the site.

```
RewriteEngine On
RewriteRule ^([a-z]{2})/([a-z]+)$ index.php?lang=$1&section=$2
```

![Figure 2.c: Rewriting of a URL on an Apache web server.](http://example.com/en/home)
4.1.2.6 Providing guidelines for writing good web copy

Writing in a certain way can greatly improve search engine rankings. A CMS could provide simple guidelines for writing good web copy as a step in linguistic SEO. Such guidelines could be presented for authors when writing content, and could include guidelines suggested by Nielsen and Loranger [4] and Krug [5] such as:

- Avoid "empty" text
- Provide the essentials as soon as possible
- Use keywords related to the content when writing

Although this could have a positive effect for search engine rankings, it could also harm readability if the intended readers are disregarded when writing. The purpose of this feature should therefore be to improve general readability as well as improving linguistic SEO.

4.1.2.7 Providing tools for finding good keywords

Using keywords in the correct places in a document results in the site obtaining better search engine rankings for those keywords. However, it is just as important to choose the correct keywords – they should correspond to words that users would use to find the site. Good places for finding appropriate keywords are in logs where they would naturally occur, such as search logs and referrer logs.

If a CMS features an internal search function, it could log searches and scan that log to find commonly used terms.

A CMS could also log referring URLs using the hypertext transfer protocol (HTTP) referer request-header and extract search terms used on major search engines to find the site. Figure 3 shows an example of a captured HTTP referer request-header from Google, where the search terms used have been highlighted.

http://www.google.se/search?hl=sv&rlz=1G1GGLQ_SVSE339&q=example+of+referer&btnG=S%C3%B6k&aq=f&aqi=&aql=&oq=&gs_rfai=

Figure 3: A captured HTTP referer request-header URL from Google.
4.1.2.8 Providing tools for managing keywords

Allowing the creation of controlled vocabularies with features such as synonyms, preferred terms and common misspellings could contribute to a more consistent use of keywords throughout the site. This would contribute to linguistic SEO but also benefit users who could otherwise become confused if different terms are used within the site for the same type of content.

4.1.2.9 Providing tools for using keywords when writing

If the CMS features the creation of controlled vocabularies for keyword management, such a vocabulary could be used to inform authors of keyword usage when writing web content. A requirement for this solution would be that each separate piece of content has keywords related to it, and it should be noted that its effectiveness would rely greatly on the actual relevance of the keywords.

Suppose that an article with a title and a text is to be written. The author enters keywords for the article, and then begins to write it. When submitted, the CMS could scan the title and the text for the entered keywords and give feedback regarding how those keywords are used. Such feedback could consider:

- Does the keyword appear in the title of the article?
- Does the keyword appear within the first two sentences of the article?
- Is the keyword used sufficiently frequently, or perhaps so often that it harms readability?

This would provide the author with direct feedback regarding how keyword usage would effect linguistic SEO. If the vocabulary has features including synonyms with preferred terms and common misspellings, a CMS could also notify the author of an incorrect use of "wrong" or misspelled keywords and suggest the use of the preferred or correct spelling of the term instead.
4.2 Finding within a site

This task includes how users look for information within a site, what users expect to find, and what navigational tools a user expects to be included on a site.

4.2.1 Analysis

Internal search and discovery issues cause nearly half of all task failures on web sites [4], which makes room for much improvement. Faulty information architecture and poorly implemented internal search functions are the two single areas that are most prone to causing errors [4].

Since information architecture is closely related to site navigation, it should be a good candidate for improvements. Primary (or embedded) navigation is usually hierarchical, and will thus have an ambiguous organization scheme. A good hierarchy should have a balanced breadth-depth ratio, with the exception of sites that are expected to grow which could instead aim for a slightly more broad-shallow design [6]. Furthermore, because of the subjectivity when categorizing content, labels used within the hierarchy should be descriptive and be consistently used [6]. The importance of labeling navigation categories correctly is even clearer if satisficing and information foraging theory are considered. Having relevant labels would assist users in making correct choices if considering satisficing theory, since their first reasonable option would probably be correct. For information foraging a good label would act as a strong information scent, and thus encourage the user to keep following the trail towards the desired information.

Supporting different kinds of navigation is also important since users usually use either embedded or supplementary navigation [4], but will likely use the other if the first one fails to deliver [6].

According to Nielsen and Loranger [4] and Morville and Rosenfeld [5] it is important to communicate a user’s current position within the site, so incorporating such cues in site navigation, and perhaps featuring breadcrumbs, could also be included.
Considering that the internal search function is usually one of the two primary navigation choices for users, it should be of utter importance that it produces relevant results. The fact that users use search engines often is also reflected in what they expect from a search function. They expect a search function to have a text box and a search button, they expect it to be a keyword search and they expect a SERP that reminds of a major search engine SERP. [4]

4.2.2 Solutions

This part of the chapter presents possible solutions to the facts and issues discussed in chapter 4.2.1.

4.2.2.1 Supporting different kinds of organization structures

Since different organization structures come with different advantages, a CMS should support the organization of content in different ways. However, this usually occurs naturally for different kinds of content. Heterogeneous content, which features few common elements, will normally be placed within a hierarchy which would provide the context to enable the content to be found [6]. Homogeneous content, such as a blog (its posts are homogeneous since they share the same basic structure), will on the other hand allow it to be structured in a more exact fashion [6], in this case chronologically.

A CMS can therefore accomplish this simply by supporting different kinds of content, collections of content, and providing a logical means for their navigating.

4.2.2.2 Providing tools for creating links in content

This relates to the previous solution, since it is essentially another kind of information structure: the hypertext organization structure. It is not suitable as primary navigation, since the context it provides is highly subjective, but can act as a good compliment to the other kinds of structures [6].

By providing tools for creating links in content, a CMS allows authors to provide related content as contextual navigation and thereby supports associative learning [6]. This is also an effective place to have links, since most clicks in interior pages occur in the main content area [4].
4.2.2.3 Providing tools for creating good information hierarchies

A CMS could provide a tool that analyzes an information hierarchy, and then suggests improvements based on the calculated breadth-depth ratio. By providing users with this feedback, a CMS could prevent information from being structured in ways that are inaccessible and difficult to navigate.

4.2.2.4 Generating locational cues in navigation markup

Although visual "you are here"-cues are usually applied with CSS (and thus falls outside of the responsibilities of a CMS), a CMS could provide the markup required for these visual cues to be applied. This could be accomplished by using the class.attribute to indicate that a certain category, subcategory and page is currently selected. CSS could then be used to make the navigational elements that possess certain attribute values to differ from the regular appearance of the navigation.

4.2.2.5 Featuring the creation and managing of site maps

Since supplementary navigation is important for any but very small sites, the creation and use of such navigation should be supported by a CMS. Site maps would be one of those types of navigation, and they could be generated automatically using the information a CMS has about a site's information hierarchy. A site map should reflect a hierarchy in order to clarify how information is organized [6], so this should be a good approach. Since a site map should also be careful not to include too much information [6], an option of not including a page in a site map should be available when it is created.

4.2.2.6 Featuring creation and managing of site indexes

A site index is another component of supplementary navigation, and should be supported by a CMS to allow for ease of browsing for users who know the exact name in relation their search. A site index could either be created and managed manually by sorting content into categories, or generated automatically by using properties that are common to all content (such as title, subject, author etc.).
4.2.2.7 Featuring breadcrumbs

Breadcrumbs are particularly effective in communicating a user's location within a site, since they show the current position as well as the logical path that has led to that location. A CMS could automatically generate markup for breadcrumbs since it would have information about users' locations and the structure of the underlying hierarchy.

4.2.2.8 Providing tools for managing keywords

This is also suggested in chapter 4.1.2. Its primary benefit in relation to discovery within a site is in the use of a controlled vocabulary when writing navigational labels, as well as when writing content, which will improve the consistency of terms used within a site in general. This makes it easier for users to navigate the site, since they know what to expect from a certain term. Such a vocabulary could also be used by a search function to find relevant results for search queries.

4.2.2.9 Providing guidelines for writing effective labels

Good labeling is essential for almost every part of information on a site, and especially for effective navigation, so a CMS could provide its users with guidelines for writing effective labels. If considering the guidelines provided by Morville and Rosenfeld [6], such guidelines could include:

- Using a consistent spelling style
- Using consistent syntax
- Using consistent granularity
- Considering the comprehensiveness of grouped labels
- Considering audience when using terms

By this means it could contribute to making navigational labels more comprehensible in general.
4.2.2.10 Featuring a search function

Since the search function is such a commonly used navigational feature, a CMS should provide it but its use should however be optional, as a search function is not always required [6].

It should be keyword based since this is expected by users, and in order to provide relevant results it could use keywords entered for site content. If a controlled vocabulary exists, and it features synonyms and common misspellings, the vocabulary could be utilized to assist in the production of relevant results for terms that also loosely relate to content keywords.

The SERP produced should be formatted to mimic those produced by major search engines, since this is expected by users. The actual search box should be at least 30 characters wide, since it would then fit 90% of search queries [4].

4.2.2.11 Enabling search log analysis

If a CMS provides a search function, search logs should also be retained and made available. A search log provides words that are entered by actual users, so it is a good source for finding keywords that are commonly associated with content on a site. If a specific term is discovered to be entered very frequently, and is not currently in use on the site, then this would provide the motivation to incorporate it.

4.2.2.12 Providing tools for creating best bets for popular search queries

If a CMS runs a search log that keeps track of popular queries, these could be used to create best bets for those queries. A best bet is a manual search result, which is recommended by a human for that specific search query [4]. By allowing for this, a CMS could assist in improving result relevance for popular queries.

4.2.2.13 Enabling writing summaries for content

Writing summaries for content has several benefits, but in this case the primary advantage would be that they could be used in SERPs produced by the internal search function. If a summary were to be placed before the actual content, it would also benefit linguistic SEO and readability.
4.3 **Reading and understanding site content**

The task of reading and understanding a site’s content includes how users read, what people read, what affects readability and what affects users’ ability to understand what they read.

4.3.1 **Task analysis**

Problems related to page design and content quality account for about 25% of task failures for users, and poorly written content by itself accounts for almost 20%. If dissatisfaction is instead considered, bad page design is the reason in more than 20% of all cases, while content quality is roughly the same as for task failures. This means that poor page design causes more irritation than actual failure, but since users might leave a site if it causes too much annoyance it should still be considered as being important. [4]

A CMS should therefore attempt to aid both these areas in order to improve general usability. Page design includes areas such as layout, color schemes and typography – areas that are mostly accomplished by the use of CSS and graphics and thus falls outside the responsibilities of a CMS. However, a CMS could aim to provide the markup required in order for CSS to be applied in a fashion that improves usability.

A CMS could also aim to produce markup that in itself promotes accessibility and compatibility across different hardware and browsers.

A CMS could also attempt to include page elements that assists people to understand what they are reading, such as titles, summaries and date stamps. Conforming to the way that people read on the web should also be considered, since it would help people to find what they are scanning for and present it in an accessible fashion.

Since many problems are related to the actual content that is presented on a site, a CMS should also strive to provide authors with tools and information that assist in the improvement of the site content.
4.3.2 Solutions

This part of the chapter presents possible solutions to the facts and issues discussed in chapter 4.3.1.

4.3.2.1 Providing tools for creating layout markup

Although a CMS is not responsible for presentation, the ability to group content using markup would allow designers to present information in clearly defined areas. This would make it easier for users to find appropriate areas to scan for relevant information [5]. Since users usually spend most time scanning the main area of a page [4], it should be considered very important to provide them with such an area.

This could be accomplished by allowing a piece of content to be placed within a `<div>`-element, which could then be marked with either an `id`-attribute or a `class`-attribute.

4.3.2.2 Conforming to the WCAG and the ATAG

Following the guidelines presented by the WCAG and the ATAG will ensure that outputted markup is accessible for users with disabilities, but also ensure that the CMS itself is accessible. It will also benefit users with different hardware, browsers and work environment conditions.

Since the guidelines themselves and techniques for implementing them are presented at the WCAG and ATAG web pages, this thesis will not discuss them in further detail.

4.3.2.3 Providing tools for monitoring site testing

In order to raise awareness of the importance of testing the site using different browsers, operating systems, devices, screens etc. a CMS could provide a tool for monitoring site testing. Such a tool could be as simple as providing a checklist for testing the site in certain ways, and could consist of:

- Testing the site in different browsers/operating systems
- Testing the site using different screen resolutions
- Testing the site on different screens
• Testing the site on hand-held devices

• Testing the site using different download capacities

• Testing the site without images

• Testing the site without CSS

• Testing the site without colors

• Testing W3C standard conformance (by using a HTML validator)

A more advanced approach could be to enable check boxes and notes for each stage of testing, and then using that information to generate compatibility reports.

4.3.2.4 Featuring headings and subheadings in content

Headings and subheadings effectively communicate the information contained by a page and how it is structured [4]. Since this would help users to quickly scan the page for relevant information, a CMS should feature the use of headings and subheadings in content.

4.3.2.5 Featuring summaries for content

By allowing authors to write summaries for site content, a CMS could provide users with a quick overview of the content of a page and thus provide the user with a hint as to whether or not the content is relevant.

4.3.2.6 Providing content with date stamps

Outdated content that is presented as up to date may provide users with incorrect information, and this may happen if site content is not updated on a regular basis [4]. By providing a date stamp for content, users can gain sufficient information in order to decide whether a certain piece of content is reliable even if it is not regularly updated.

Since a CMS commonly incorporates version control and editing logs for content, information about when a specific piece of content was created and last edited could be provided in order to better portray the actuality and updating pace of that content.
4.3.2.7 **Featuring lists in authoring interfaces**
The use of vertical lists in content is effective for making points easier to read and understand, and can significantly improve the usability of a text [4]. A CMS should therefore feature the creation of lists, both ordered and unordered, in authoring interfaces.

4.3.2.8 **Featuring buttons to set text size for content**
Although this feature is usually not necessary for mainstream sites, it should be employed by sites that target users with any type of reduced vision [4]. A CMS could provide the choice of including buttons for increasing and decreasing text size, perhaps together with instructions for when it is appropriate to include them.

4.3.2.9 **Featuring tools for analyzing content text**
Writing short paragraphs that are rich in content is essential to make text seem comprehensible. In addition, it makes text more scannable and improves the general readability of the text. [4]

A CMS could feature a tool that analyzes the paragraphs of a text, and provides feedback to authors about paragraphs that are too long or contain too many sentences.

4.3.2.10 **Providing guidelines for writing good web copy**
Since many task failures are related to poorly written content, general guidelines for writing good, user oriented content can be provided to authors. If considering the guidelines provided by Nielsen and Loranger [4] and Krug [5], such guidelines could include:

- Keep paragraphs short
- Use simple, user oriented language
- Start with the essentials and then go into details
- Avoid bureaucratic text
- Avoid using "empty" text
- Avoid using marketing hype in excess
• Avoid jargon

• Avoid using sarcasm, wordplay and acronyms in excess

Providing guidelines such as this could result in better site content in general, and would probably also improve linguistic SEO.

4.3.2.11 Integrating authoring interfaces with vocabularies

If a CMS features a controlled vocabulary with synonyms and preferred terms, such a vocabulary could be integrated with authoring interfaces so as to monitor the use of keywords. By doing this, a CMS could then detect improper use of terms included by the vocabulary, and thus suggest the use of the preferred term. Doing this could result in more consistent use of terms throughout the site, and thus help users to better understand the meaning of commonly used terms.
5 Results

Chapter 5 presents the evaluation of the solutions found during the work for this thesis. First of all the evaluation results for each solution are presented, followed by an overall display of the level of integration of the solutions in each of the general areas covered by this thesis.

5.1 Evaluation result

This part of the chapter presents the evaluations of the solutions found in chapter 4. Table 1 shows how each solution corresponds to the following criteria (based on the questions in chapter 1.4):

| a) The solution automatically improves usability |
| b) The solution actively promotes usability |
| c) The solution provides tools for improving usability |
| d) The solution provides instructions for improving usability |

Table 1: Evaluation results for each solution

<table>
<thead>
<tr>
<th>Finding a site</th>
<th>a)</th>
<th>b)</th>
<th>c)</th>
<th>d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producing semantic markup</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enabling text equivalents for non-textual content</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing guidelines for writing good text equivalents</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Featuring automatic creation of site maps and breadcrumbs</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using textual URLs</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing guidelines for writing good web copy</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Providing tools for finding good keywords</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing tools for managing keywords</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing tools for using keywords when writing</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Finding within a site</th>
<th>a)</th>
<th>b)</th>
<th>c)</th>
<th>d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supporting different kinds of organization structures</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing tools for creating links in content</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing tools for creating good information hierarchies</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Generating locational cues in navigation markup</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Featuring the creation and managing of site maps</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Aiding web usability
Integrating usability with Web Content Management Systems
Alexander Velander

5 Results
2011-04-06

| Featuering creation and managing of site indexes | X |
| Featuring breadcrumbs | X |
| Providing tools for managing keywords | X |
| Providing guidelines for writing effective labels | X |
| Featuring a search function | X |
| Enabling search log analysis | X |
| Providing tools for creating best bets for popular search queries | X |
| Enabling writing summaries for content | X |

### Reading and understanding site content

| a) Providing tools for creating layout markup | X |
| Conforming to the WCAG and the ATAG | X |
| Providing tools for monitoring site testing | X |
| Featuring headings and subheadings in content | X |
| Featuring summaries for content | X |
| Providing content with date stamps | X |
| Featuring lists in authoring interfaces | X |
| Featuring buttons to set text size for content | X |
| Featuring tools for analyzing content text | X |
| Providing guidelines for writing good web copy | X |
| Integrating authoring interfaces with vocabularies | X |

As shown by Table 1, solutions have been found for each of the criteria specified, which means that the evaluation results answer the questions formulated in chapter 1.4.

### 5.2 Result distribution

This part of the chapter displays the evaluation results distribution in general, as well as for each area. As shown in the general distribution of the evaluation results (Figure 4), the majority of the solutions found (60.6%) were tools for improving usability. Solutions for the other criteria have also been found, and they are evenly distributed across the remaining percentage.
Aiding web usability
Integrating usability with Web Content Management Systems
Alexander Velander

5 Results
2011-04-06

Figure 4: The general distribution of the evaluation results

Figure 5 shows that the result distributions for each area are relatively uniform, although some differences can be noticed for each area when comparing them to the general distribution. The area involved in finding a site has the smallest share of tools for improving usability, and also holds the largest percentage of both solutions that automatically improve usability and instructions for improving usability. Finding within a site has the highest percentage of tools for improving usability, and also holds the smallest shares in relation to the other kinds of solutions. Reading and understanding corresponds relatively well to the general distribution.

Figure 5: Distribution of results according to areas
6 Discussion

Chapter 6 discusses the solutions and evaluation results discovered during the work for this thesis. The overall aim of this thesis was to determine whether usability guidelines can be integrated with a CMS in order to promote and deliver usability. In addition, such solutions should aid web site users when carrying out basic tasks on the web. This thesis has proven that it is possible to find such solutions, and has found several such solutions for each of the basic user tasks of finding, reading and understanding information on the web.

6.1 Evaluation result

This part of the chapter discusses the results of the solution evaluations, and how they correspond to the questions raised in the low level problem statement. The questions were:

1. Can solutions be found that enable a CMS to prevent common usability problems from occurring?

2. If such solutions can be found:
   a) Can such solutions automatically improve site usability?
   b) Can such solutions actively promote usability within a CMS?
   c) Can such solutions provide tools for improving site usability?
   d) Can such solutions provide instructions for improving site usability?

This thesis has found several solutions that enable a CMS to prevent common usability issues from occurring, and thus has proven that it is possible to find such solutions. Furthermore, the evaluations show that the solutions found during the work for this thesis can also answer the other questions formulated in the low level problem statement.
Can solutions be found that automatically improve site usability? Yes, and such solutions represent 15.2% of the solutions found during the work for this thesis. Such solutions were found for each of the areas covered by this thesis, although they were slightly more common in the areas of finding a site and reading and understanding information. This shows that it is possible for a CMS to automatically improve usability, but the low percentage also suggests that a great deal of human effort is still required in order to improve the overall usability of a site.

Can solutions be found that actively promote usability within a CMS? Yes, and such solutions represent 12.1% of the solutions found. This shows that it is possible for a CMS to actively promote usability within the areas covered by this thesis, but also that only a small number of problems can be solved by implementing this type of solution.

Can solutions be found that are tools for improving usability? Yes, and such solutions represent 60.6% of the solutions found and thus form the most common types of solution found during the work for this thesis. This shows that it is possible for a CMS to find tools for improving usability, and the large percentage also hints that usability engineering would still require deliberate human efforts even if a CMS implemented the solutions suggested by this thesis. The results also show that the area of discovering within a site has a significantly larger share in relation to this type of solutions. This can probably be explained by the fact that it greatly depends on good site navigation, which in turn is highly dependent on the logical information structure and good labeling. Since these are areas that target human comprehension and human language, it is of no surprise that they require greater human effort in order to be effective.

Can solutions be found that provide instructions for improving usability? Yes, and such solutions represent 12.1% of the solutions found. This shows that it is possible for a CMS to provide such instructions, and also that only a small number of problems can be solved by implementing this type of solution.
The actual efficiency of the solutions should perhaps be considered since the solutions presented by this thesis are purely supported by theory. A general usability guideline is valid in roughly 90% of all cases, but since it may not apply in 10% of all cases, practical measurements are usually required to guarantee the effectiveness. This should however not significantly affect the generality of the solutions.

6.2 Future work

This thesis covered the basic user tasks of finding, reading and understanding information on the web. Although these areas hold the majority of severe usability issues, there are several other areas that could also prove to be of interest to investigate. A CMS could, for example, re-sample uploaded images in order to improve loading time for a site, but since that solution does not fit well into the areas covered by this thesis it was not included.

It would of course also be interesting to implement the solutions found in an actual CMS. They could be considered when constructing a CMS, but could also be used to extend the functionality of existing CMSs. Good candidates for the latter could be widely used open source CMS projects such as Joomla or Drupal, since the number of potential users of such extensions would be massive. It would be very interesting to see what impact such an extension would have on those sites' general usability.

6.3 Final remarks

This thesis has shown that it is possible to integrate usability guidelines with a CMS in order to promote and deliver usability. Usability engineering does however remain a highly human dependent process, but hopefully the solutions found during the work for this thesis will provide the users of a CMS with sufficient support to improve general site usability.
Aiding web usability
Integrating usability with Web Content Management Systems
Alexander Velander

References


http://www.w3.org/TR/REC-html40/  
Retrieved 2010-11-03.

http://www.w3.org/TR/xhtml1/  
Retrieved 2010-11-03.