

Page Design Guidelines Developed through Usability Testing

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Introduction

The World Wide Web (WWW) has become a very popular means for publishing information. A large number of information repositories (Web sites) already exist and new ones are being created at a very rapid rate. Most of the pages on WWW repositories provide elements that allow users (readers) to interact with them. Thus, the people designing pages for the WWW are actually designing user interfaces.

The proliferation of pages with poor usability suggests that most of the designers of WWW pages have little knowledge of user interface design and usability engineering. This is a serious problem that needs to be addressed since pages with poor usability can have the following negative effects:

- User frustration: caused by not being able to find the information sought, disorganized pages and confusing information, pages under construction and disconnected links, the lack of navigation support, and other problems.
- Discourage exploration: the barriers imposed in the poorly designed interface and the user's lack of trust or faith on the site will discourage further exploration of the site.
- Waste of time: disorganized pages, misleading link names, long pages, and long download times results in large amount of wasted time for the users.
- Increase Internet traffic: the problems mentioned above not only affect the use of a particular site but are also responsible for a large unnecessary traffic on the Internet.

Web pages with poor usability can also have negative effects for the site owners. It could result in a reduction of visits to the site, negative feedback from frustrated users, and a negative image for the site. Thus, from all points of views, it is very important to develop practical methodologies for designing usable Web pages.

Web design has become a very popular topic in recent years. This is manifested by the increasing number of books, courses, tutorials, and articles on the topic. Many guidelines for designing Web pages can be found in the WWW. Among the most comprehensive are: "Guide to Web Style" by Rick Levine from Sun Microsystems (Levine, 1995), "The Web Style Manual" by Patrick Lynch from the Yale Center for Advanced Instructional Media (Lynch, 1995), and "Elements of Web Design" by Ben Benjamin from CNET (Benjamin, 1996). These works are very complete, yet very extensive. In addition, most are based on personal experiences and observations, and are not supported by formal experimentation. Shorter articles on this topic include the papers by Hagan Heller and David Rivers (Heller, 96), Tim Comber (Comber, 1995).

Various methods for designing pages with good usability are suggested in two studies conducted by Jakob Nielsen (Nielsen 1994b, 1995). However, some of these methods are not practical for most page designers because they require user testing and are time consuming. Also, most designers of Web pages lack the appropriate facilities, resources, and usability engineering expertise to effectively apply some of the methods recommended.

A more practical alternative for most page designers is to provide them with a set of simple guidelines for designing Web pages that avoid the common mistakes found in many of the pages

today, and that promote usability. These guidelines should be based on fundamental principles of user interface design, but should be simple enough for non-experts to understand and apply. The goal of our work is to develop a set of guidelines that meet the following criteria:

- They should be short, simple, and practical. In other words, they should be easy to read and understand.
- The users should not need to have user interface design and usability engineering knowledge to apply them.
- They should be supported by usability evaluation and testing.

The following sections describe the development process and the usability evaluations performed to generate a set of guidelines for designing usable WWW pages.

Heuristic Evaluation of WWW Sites

The design of a good user interface usually requires the use of various usability evaluation methods. Among these, the heuristics evaluation method (Nielsen, 1994a) is the least expensive method and yet one of the most useful. Thus, in our quest for a good set of guidelines for designing Web pages, we started by conducting a heuristic evaluation of pages of existing Web sites. Due to the diversity of existing repositories, we felt it necessary to begin the study with a group of Web sites with similar characteristics. Thus, it was decided to start the study with a heuristic evaluation of university and college Web sites.

A sample of ten repositories was randomly selected from a listing of more than a thousand colleges and universities (DeMello, 1996). Home pages (the first page of a site) and secondary pages (the other pages) of each site were evaluated by three evaluators. The evaluation was based on a set of ten usability heuristics (guidelines) for designing user interfaces (Nielsen, 1994a).

The heuristic evaluation detected a variety of usability problems, most of which were related to the following three heuristics developed by Jakob Nielsen.

***Aesthetic and minimalist design:** Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.*

***Match between system and the real world:** The system should speak the users' language, with words, phrases, and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.*

***Consistency and standards:** Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.*

Dialogue Problems

The majority of the problems encountered were related to the *Aesthetic and minimalist design* heuristic. Some of the pages evaluated had headers that took a substantial portion of the visible area of a page. These big headers reduce the visible area available for placing relevant information, what in many cases forces the users to scroll more than they would need to. In some cases the headers and footers were not clearly separated from the body of a page. These pages were perceived as disorganized because the information was not properly grouped. Since headers are mostly used to emphasize the theme of the page, they must be clearly separated from the body of the page to get the users attention. Footers usually provide information that is not directly related

to the content of the page. Since they serve a different purpose, they must be clearly separated from the body of the page.

Various pages were found that had links with explanatory comments attached. The intention of these comments were to provide a notion of the content of the page the links pointed to. In most cases this practice is unnecessary because it adds redundant information to a page. The name of a link should be good enough to provide a hint of the page it points to. Another undesirable practice found was the practice of making a link every time the same keyword is mentioned in a segment of text. We refer to this practice as "linking mania". The problem with this practice is that it adds redundant links to the page, that compete with other links and the relevant information of the page.

Some of the dialogue problems encountered were unique to the home pages of the repositories (the primary pages of the repositories). The home pages are the gateway of a Web site. Their main function is to provide an idea of the most important aspects of the site and direct users to them. Since these pages are the most frequently accessed pages of a Web site they should be designed in such a way that the users can get a good feel of the main aspects of the site and quickly move on to the path that will get them to the desired information.

Some of the home pages included one or two paragraphs about the organization. This information is intended to advertise the organization, however, it could be irrelevant for most users, especially the ones that visit the page regularly. In addition, the inclusion of such information increases the size of the page what forces the users to scroll. As a result, it takes the users a longer time to get a feel of the Web site and to navigate. This is certainly not appreciated by users because according to usability studies conducted by Jakob Nielsen (Nielsen, 1996) users don't want to scroll and don't want to read.

Some of the home pages evaluated were not well organized and, thus, did not provide a good feel of the most important aspects of a site. One of the problems encountered was the disorganized mixing of links to primary topics and to secondary topics. Another problem encountered was the inclusion of links to non-primary pages of the site.

Language Problems

It was very common to find links with names that did not provided a good hint about the page they pointed to. Some link names included words that were not commonly understood by most users. These link names can introduce navigation problems because the users could end up following the wrong links. This action wastes user time and causes an unnecessary traffic on the Internet. A similar problem results when images or icons are used to link to other pages. If these images do not provide a distinctive feature of the page they point to, the users have no idea of the information they will be accessing.

Consistency Problems

Most of the consistency problems encountered were related to footers and navigation elements. Some sites did not make a consistent use of footers and navigation elements across the site.

Other Problems

Two additional problems encountered are worth mentioning. First, it was found that some links were pointing to pages that did not exist. Following one of these links would obviously result in a waste of time for the users. The second problem was related with the reproduction of hard copies of the pages. Some pages had images with colors that did not reproduce well on black and white printouts. This results in loss of valuable information when the pages are printed.

Useful Features

During the heuristic evaluation the evaluators noticed the use of two useful features in some of the pages. One of these features was the inclusion of a link to an index of pages of the site. This feature could be very useful because it allows a quick access to the pages of the site without much navigation. The other feature was the inclusion of a footer with information and links related to the pages. These footers usually indicated information such as: the last date the page was modified, an e-mail address for sending comments about the page, and the Internet address of the page.

Based on the usability problems encountered from the heuristic evaluation of colleges and universities, a list of guidelines for designing Web pages was compiled (see Figure 1).

User Testing of Guidelines for Designing WWW Pages

To evaluate the proposed guidelines we conducted an experiment with two versions of the home page of three Web sites randomly selected from the ten colleges and universities Web sites evaluated (Borges, 1996). The two versions were the original home page and a redesigned of the original home page. The redesigned versions were developed by three persons with WWW page design experience. Each designer was assigned a different home page. They were provided with a copy of the proposed guidelines and were instructed to redesign the home pages, without any constraint, except that he/she should apply the guidelines provided. No explanation was given about the guidelines.

<p style="text-align: center;">Guidelines for Designing Usable World Wide World Pages</p> <p><i>For any page,</i></p> <ol style="list-style-type: none">1. Headers should not take more than 25% of a letter size page.2. Headers and footers should be clearly separated from the body of the page. (One way of achieving this is by placing bold lines or bars between them and the body.)3. Names of links should be concise and provide a hint on the content of the page that they link to. (Avoid using technical words such as servers, links, web server, etc.)4. Avoid adding explanatory comments to textual links.5. Avoid "linking-mania" (making a link every time a keyword of a page is mentioned in a text).6. Verify that links connect to existing pages.7. Linking icons should have a distinctive feature of the page they are linking to.8. Maintain consistency when using icons. The same icon should be used for the same intended purpose.9. Colors should be selected so that the pages can be clearly displayed and reproduced on black and white displays and printers.10. It is desirable to include the date the page was last modified, the mail address of the person that maintains the page and the URL address of the page on a footer. <p><i>For the home page of the repository,</i></p> <ol style="list-style-type: none">11. Descriptive information about the institution should be placed just below the header and kept to a minimum (a link to a secondary page is preferred).12. Pages should not be overcrowded with links.13. Pages should be short (about a letter size page).14. Links should be to primary aspects or characteristics of the institution. Textual information should be left for secondary pages.15. Organize links as primary and secondary topics.16. Links to resources or other repositories on the Internet should be placed on a secondary page. (This page should be reached with a link on the primary page.)17. A more extensive index of links, properly grouped, can be provided on a secondary page for fast access to a wide range of the institution's repositories.

Figure 1. Proposed Guidelines for Designing Usable World Wide World Pages (Borges, 1996).

Ten users with different levels of WWW experience were asked to perform five tasks on the original versions and another ten users on the redesigned versions. Tasks one, two and three required the users to select a link at the top, middle and bottom of the home page respectively. The fourth task requested the users to find the home page of the computer science department. The fifth task requested the users to find information about the university's library resources.

A summary of the results is presented in Table 1. The times indicated on the table correspond to the average time that ten users took to complete each task. The results of the test indicated that the average time to complete the large majority of the tasks on the redesigned home pages was significantly reduced. There were three cases in which it took the users a longer time to complete the task with the redesigned page. To get a better understanding of these results we analyzed both versions of the three home pages according to their compliance to the guidelines.

Table 1. Results of Usability Test of WWW Page Design Guidelines (Borges, 1996).

	Home Page A			Home Page B			Home Page C		
	Average time (sec.)		Percent reduction	Average time (sec.)		Percent reduction	Average time (sec.)		Percent reduction
	Original	Redesigned		Original	Redesigned		Original	Redesigned	
Task 1	24.0	5.4	+78	11.0	7.2	+35	7.0	4.3	+39
Task 2	13.1	2.3	+82	12.2	3.7	+70	4.0	18.5	-363
Task 3	11.9	3.8	+68	20.4	8.2	+60	4.4	7.1	-61
Task 4	31.9	19.2	+40	17.9	29.2	-63	21.9	5.4	+75
Task 5	35.8	30.1	+16	13.4	6.8	+49	11.2	6.9	+38

The original version of Home Page A was too long (about two letter size pages long), it was overcrowded with links and explanatory comments, and it used approximately one fourth of its space to provide information not related to the site. The redesigned version was a short page (about half a letter size page) that improved all these aspects and thus, was more in compliance with the guidelines. These improvements in the redesigned version helped improve the usability of the home page.

The original version of Home Page B was too long (about two letter size pages). It had a long header (half a letter size page) and many links with explanatory comments. The redesigned version was a shorter page (about half a letter size page) with a smaller header and fewer links (none with explanatory comments). The redesigned version did not include a link to an index page (a page consisting of links to most of the pages of the site) that was present in the original version. This link was used by several of the users of the original home page to speed up the information search on tasks 4 and 5. We believe that the omission of this link in the redesigned version was responsible for the increase on the average time to complete task 4.

The original version of Home Page C was a short page (about half a letter size page) with very few links. This page complied with most of the guidelines. The redesigned version was a long page (longer than a letter size page) with a longer header (about one third a letter size page) and a larger number of links. The increase on the average time to complete tasks 2 and 3 of the redesigned version was due mostly to the increased page size and header size. However, there was an

additional factor that contributed to the large time difference that resulted for task 2. The redesigned home page featured four large arrow-like icons below the header. Only two of these icons were visible on the browser window at the beginning of the test. It seems that the users perceived these icons as navigation buttons that marked the end of the page because most of them did not attempt to scroll the page, which was necessary to reach the link that allowed them to complete the task. The page size and header size was not a major factor for tasks 4 and 5 because the redesigned page featured, in a prominent place, a link to a local search facility that many users used to complete the task. This link was also available in the original homepage but was not very visible.

Our evaluation of the redesigned home pages showed that none of them properly complied with guideline 14 of the proposed guidelines. In an interview with the designers of the redesigned pages, they expressed that their selection of topics and keywords was greatly influenced by the original home page assigned to them. Another significant observation was that guideline number 17 was discarded by the three designers. From the interview with the designers we concluded that this guideline was not clearly understood.

Heuristic Evaluation of Commercial Web Sites

The experiment described in the previous section demonstrated that designers of Web pages can improve the usability of home pages by applying the proposed guidelines. However, a wider sample and variety of sites needed to be evaluated to refine and produce a more complete set of guidelines. With this objective in mind we decided to conduct a similar study with commercial sites. Twenty sites were randomly selected for the study. The selected sites were of an heterogeneous business nature (book publishing companies, a car maker, a pet shop, a communications company, entertainment companies, specialties stores, food stores, a money transferring company, an electronic magazine, and computer shopping companies). None of the sites had previously been visited by any of the three evaluators that participated in the study. Again, the heuristic evaluation was based on the usability heuristics developed by Jakob Nielsen (Nielsen, 1994a).

In general, the pages of the commercial sites were more attractive than the pages of the colleges sites because they make more use of artistic images. However, in terms of usability problems they were very similar to the colleges and universities home pages. There was a significant number of home pages that were not well organized and crowded with text. Almost half of the home pages were relatively long.

Some minor differences from the colleges pages are worth noticing. For example, the headers of some of the home pages did not clearly identify the organization. There were more cases of image maps that did not provide an indication that they were links. There was no evidence of "linking mania" or pages crowded with links. Since these two problems were not very common on the college sites, guidelines 5 and 12 do not address a significant problem.

Since the commercial Web sites exhibit similar usability problems to the college and university home pages it is reasonable to think that their pages can be improved by applying the proposed guidelines to their design.

Improving Navigation

One of the most critical aspects of browsing pages in the WWW is navigation. Due to the way most Web sites are structured, users spend a significant amount of time moving from page to page in search for information. Inappropriate and misleading link names, confusing and disorganized pages, and other usability problems, contribute to the disorientation of users that become easily “lost in hyperspace”.

From our heuristics evaluations of Web pages we identified three page design practices that could potentially improve navigation on a Web site. These practices are: the selection of appropriate link names, the adoption of an index of links to pages or topics, and the use of navigation buttons. In the following sections we discuss how these practices can improve navigation and how to integrate them in the page design process.

Selecting Appropriate Names for Links

The selection of names for links is a very critical aspect in the design of Web pages. In most cases the name of a link is the only hint that a user has about the content of the page the link points to. If the name is misinterpreted, the user could end up reaching a useless page in his/her search for information. This situation results in a waste of time for the user and causes an unnecessary traffic on the Internet. Thus, it is important that this problem be minimized in the design of Web pages.

We feel that it is possible to help the page designers minimize the link naming problem by providing them with guidelines for selecting appropriate link names. To produce such guidelines it was necessary to get a better understanding on the nature of the problem. For this reason we decided to conduct a study on how well link names reflect the content of a page (Borges, 1997). The study consisted in asking some users to indicate what they thought was the content of the page pointed by a particular link. Fifty links randomly selected from ten commercial home pages (also randomly selected) were used for the study. Sixteen people participated in the study. Each person was provided with a hard copy of the ten home pages with the selected links identified with a number. They were asked to write, in a response sheet, what they thought was the content of the page pointed by each of the fifty links.

Each response was classified according to the clue the link name provided about the content of the page it pointed to. The following four categories were used to classify the responses:

- none* - the link name did not provide an idea of the content of the page
- wrong* - the link name provided the wrong idea about the content of the page
- fair* - the link name provided some idea about the content of the page
- good* - the link name provided a good idea about the content of the page

The category assigned to each response was determined by a consensus of the subjective opinions of three experimenters. The experimenters' opinions were based on the analysis of the content of the fifty pages pointed by the links selected for the study.

In Table 2 we present a breakdown of all the responses by category. The responses indicate that in most of the cases the names assigned to a link by page designers provide a good idea or some idea about the content of the pages the links point to. However, a significant number of links do not provide a good hint. In approximately one fourth of the cases the link names suggest a wrong idea about the content of a page. When these links are followed, the user could end up wasting his/her time. We also found that in approximately 9% of the cases the link names did not provide a clue about the content of the page. These kind of link names could discourage exploration or could result in a waste of time if followed.

Table 2. Clues Provided by Link Names about the Content of the Pages they Point to (Borges, 1997).

Category	Percentage of Cases
<i>none</i>	9.3
<i>wrong</i>	25.3
<i>fair</i>	30.1
<i>good</i>	35.3

To get a better understanding why some link names provide poor clues we analyzed the pages pointed by the ten link names that provided the worst clues. From this analysis we found that in most cases the name selected by the page designer did not reflect the content of the page. In other cases the names were too general and did not provide enough information for a person to get a least a fair guess of the page content. Some of the names were not commonly understood and, thus, most people will not have an idea about the content of the page pointed by the link.

Based on the previous analysis we found it necessary to provide a more specific guideline for naming links. We propose the following guideline:

Names of links

- Link names should reflect the content of the page they point to.
- Avoid names that are too general if you can be more specific. For example, it is more meaningful to use:
Crosswords and Comics instead of *Recreation*,
Deadlines instead of *Important Stuff*.
- Avoid names that are not commonly understood such as technical words and terms with in-house or local meaning. For example, it is more meaningful to use:
Industrial Affiliates Program instead of *IAP*,
Computer and Communications Technologies instead of *Telematics*.

Using Indices

The availability of an index of pages or topics of a Web site could be very useful because it allows a quick access to the pages of the site without much navigation. During the user testing of the original guidelines for designing WWW pages we noticed that once the users discovered an index page they would frequently return to that page while searching for information on the site.

To study the effectiveness of indices we conducted two experiments involving index pages (Borges, 1997). In the first experiment we compared the effectiveness of two types of index pages. One of them was a linear list of links to different pages of a site (see Figure 2). The header of the page featured the letters of the alphabet as links to each of the groups. The header was static (did not scroll). The other index page consisted of the same list of links used on the alphabetical index page, but organized in a table-of-content-like manner (see Figure 3). The header provided links to the main topics of the site (the topics that appear in the home page of the site).

	<u>A B C D E F G H I J K L M N</u>	
	<u>O P Q R S T U V W X Y Z</u>	
A		
<u>Academic Year</u>	<u>Arts, Description</u>	
<u>Accreditation and Affiliations</u>	<u>Arts, Elementary or Secondary Education</u>	
<u>Admissions</u>	<u>Arts, Social Work</u>	
<u>Arts (Associate Degree)</u>	<u>Athletic Activities</u>	
<u>Arts (Bachelor Degree)</u>	<u>Attendance to Classes and Exams</u>	
<hr/>		
B		
<u>Bachelor Degrees Offered</u>	<u>Biology, Department of</u>	
<u>Band and Chorus</u>	<u>Biology, Faculty</u>	
<u>Biology, Academic Programs</u>	<u>Biology (General)</u>	
<u>Biology, Activities</u>	<u>Biology, Projects</u>	
<u>Biology (Coastal Marine)</u>	<u>Business Administration</u>	
<u>Biology, Course Descriptions</u>		

Figure 2. Alphabetical Index Page

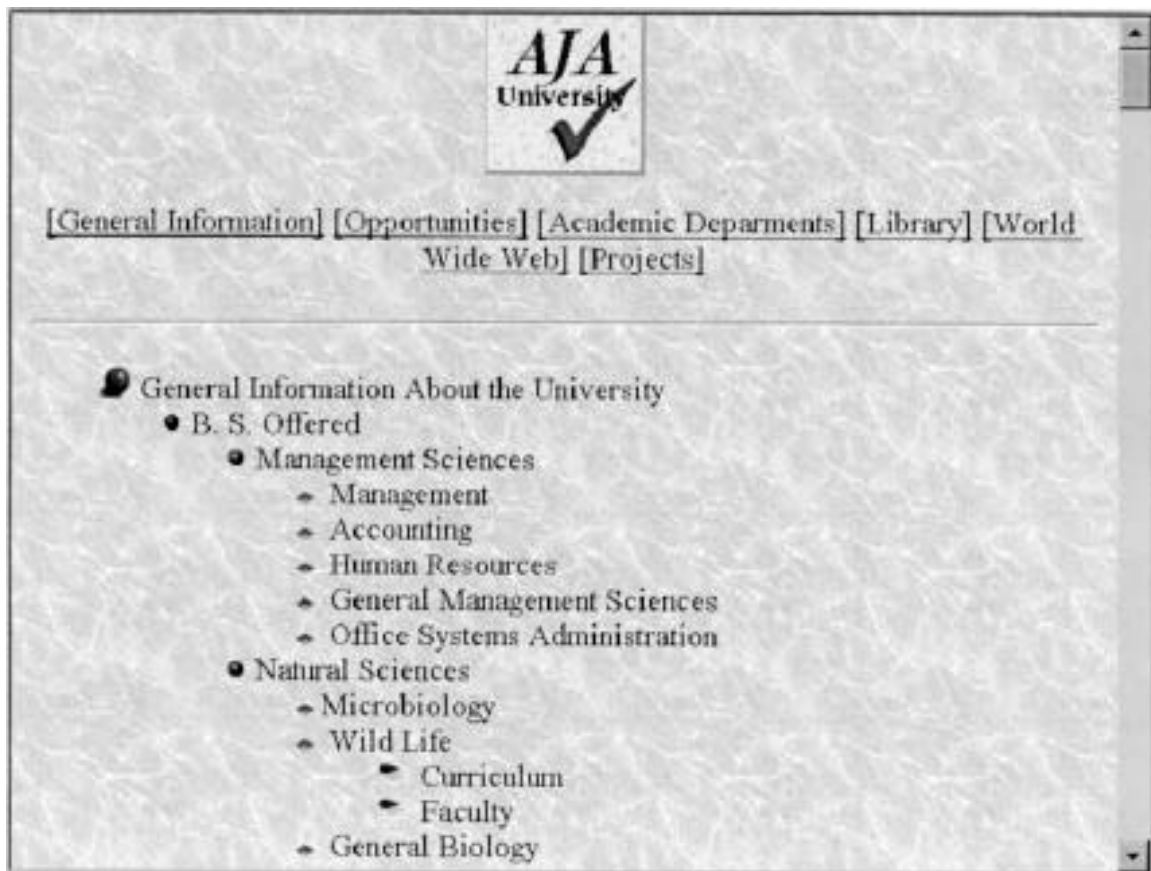


Figure 3. Table of Content Index Page

Two groups of ten Web users participated in the study. Each group was asked to perform 15 tasks that required them to look for specific information from different pages of a Web site. These pages were randomly selected from the list of links of the index page. One group performed the tasks using the alphabetical index and the other group using the table of content index. All the tasks were started on the particular index page. No instructions were provided to the users on how to use the index page. The time it took the users to select the link of the index page that allowed them to complete the task was recorded. Only the time spent by the users on the index page was accounted.

The results of the experiment are presented on Table 3. The times presented in this table correspond to the average time it took the users to find a link on each index page for each task. In 13 out of 15 tasks the average completion time using the alphabetical index was lower than that achieved by the users of the table of content index. In nine of the tasks the users of the table of content index took on average more than twice the time it took the users of the alphabetical index to complete the tasks. Thus, it's very evident that in terms of access time, the alphabetical index is superior to the table of content index.

Table 3. Comparison of Average Times to Find Links on an Alphabetical Index vs. a Table of Content Index (Borges 97).

	Alphabetical Index (average time in sec.)	Table of Content Index (average time in sec.)	Time Ratio (Table of Content /Alphabetical)
Task 1	22	75	3.41
Task 2	16	46	2.86
Task 3	28	79	2.82
Task 4	14	48	3.43
Task 5	18	10	.56
Task 6	42	94	2.24
Task 7	19	74	3.89
Task 8	20	27	1.35
Task 9	23	54	2.35
Task 10	25	26	1.04
Task 11	21	12	.57
Task 12	17	40	2.35
Task 13	10	18	1.80
Task 14	12	42	3.50
Task 15	17	30	1.76

A second experiment was conducted to determine whether the adoption of an index page can improve the navigation on a Web site. Two groups of Web users participated in the experiment. These users were different from the ones that participated in the previous index experiment. One group was asked to performed 15 tasks on a Web site. The other group was asked to perform the same 15 tasks on a modified version of the same Web site. The tasks were the same tasks used in the Alphabetical vs. Table of Content Index test. The modified version of the site had an alphabetical index of pages of the site. A link to this index page was provided in the home page of the site and on the pages pointed by the links of the home page. To prevent any bias towards the use of the index page the users of the modified version were not told about the existence of the index page. All the tasks began on the home page of the site. The time to complete the tasks (excluding page download time) was measured.

The results of the experiment are presented on Table 4. The times presented in this table correspond to the average time it took the users to complete the task on each site version. The results indicate that on average the users of the site with index were able to complete most of the tasks in a shorter amount of time than the users of the site without index. In eleven out of fifteen tasks the average completion time of the users of the site with index was lower than the average completion time of the users of the site without index. The tasks for which the users of the site without index completed in a shorter average time were four of the first five tasks of the experiment. During these first five tasks many of the users of the site with index were not aware of the existence of the index page and thus, could not benefit from it. After the fifth task most of the users were aware of the index page and used it frequently to speedup the navigation on the site. Thus, a fair comparison of the two versions of the site should be based on the results of the last ten tasks. It is evident from the results of the last ten tasks that the adoption of an alphabetical index can improve the navigation on the WWW because it helps the users find information faster.

From the experiment we found additional evidence in support of the incorporation of an index page. There were 23 cases in which a user of the site without index page could not complete a task. This contrasts with only two cases on the site with an index page. These results suggest that the incorporation of an index page results in a higher degree of success in the search of information on a Web site.

Table 4. Comparison of Average Times to Complete Search Tasks on Web Sites with and without Index Pages (Borges 97).

	Site A (with Index Page) (average time in sec.)	Site B (without Index Page) (average time in sec.)	Time Ratio (Site B/Site A)
Task 1	52	12	.23
Task 2	27	16	.59
Task 3	46	41	.89
Task 4	13	25	1.90
Task 5	15	12	.80
Task 6	63	107	1.70
Task 7	64	99	1.55
Task 8	19	91	4.79
Task 9	24	31	1.29
Task 10	17	24	1.41
Task 11	18	27	1.50
Task 12	27	118	4.37
Task 13	16	115	7.19
Task 14	18	179	9.94
Task 15	23	47	2.04

Using Navigation Buttons

Navigation buttons have the potential for improving navigation on a Web site because they facilitate a quick move to key pages of the site. From the indices studies we observed that when the users are browsing a site they tend to revisit the home page of the site. In most cases they do this by consecutive activation of the *back* button of the browser. This navigation method is ineffective if the back button must be activated more than once because the user would be revisiting pages that serve no purpose in their search for information. A faster way to get to the home page can be achieved by providing a button or link in each of the pages of the site that link to the home page. By selecting this button or link the users will get immediately back to the home page without having to revisit unnecessary pages.

Since the experiment of the indices demonstrated that when an index page is available the users would access it frequently, it is a must to include an index button in each of the pages of the site. Other buttons such as a *predecessor* button (one that links to the page that is the logical parent of

the current page) and a *top* button (one that links to the top of the current page) could be useful. However, we have not conducted studies that can support their usability.

Recapitulation

The study of commercial Web sites and the navigation studies previously mentioned have provided additional and more specific knowledge about the design of usable WWW pages. This new knowledge called for a revision of the original guidelines presented in (Borges, 1996). The revised set of guidelines is presented in Figure 4. These new guidelines are expressed in very simple terms so that any page designer can apply them. They are very useful to most page designers because they help them design usable WWW pages without spending too much time reading literature about page design. The guidelines fit in one page and only take a few minutes to understand them. The guidelines are also useful for conducting heuristic evaluations on existing pages to detect usability problems.

As technology advances new elements are integrated in the design of Web pages. This requires a constant review of page design guidelines. For this reason, we have developed a Web site to maintain the latest version of the guidelines and to illustrate the use of the guidelines with examples (Rodríguez, 1996). In the mean time, the proposed guidelines could help the new breed of interface designers (Web page designers) applied the principles of human-computer interaction and usability engineering in their designs (the Web pages).

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Guidelines for Designing Usable World Wide World Pages

For any page,

1. Headers should not take more than 25% of a letter size page.
2. Headers and footers should be clearly separated from the body of the page.
3. Names of links
 - Link names should reflect the content of the page they point to.
 - Avoid names that are too general if you can be more specific. For example, it is more meaningful to use:
Crosswords and Comics instead of *Recreation*,
Deadlines instead of *Important Stuff*.
 - Avoid names that are not commonly understood such as technical words and terms with in-house or local meaning. For example, it is more meaningful to use:
Industrial Affiliates Program instead of *IAP*,
Computer and Communications Technologies instead of *Telematics*.
4. Linking icons should have a distinctive feature or phrase of the page they are linking to.
5. Avoid adding explanatory comments to textual links.
6. Verify that links connect to existing pages.
7. Maintain consistency when using icons. The same icon should be used for the same intended purpose.
8. Colors should be selected so that the pages can be clearly displayed and reproduced on black and white displays and printers.
9. An index page should be provided on a Web site. This page should be constructed as an alphabetical list of links to pages or topics of the site. The links or topics should be grouped and listed in alphabetical order (one group for each letter of the alphabet). A link to each group should be provided in the header of the index page (A B C ... Z). The header should remain visible in the screen while the list of links is scrolled.
10. Navigation buttons should be provided in all the pages of the site. These buttons should be placed below the header of the page and above the footer of pages that require scrolling for viewing. At least the following buttons should be provided: one that links to the index page and one that links to the home page of the site. The buttons should be placed close to the right side of the page.
11. It is desirable to include the date the page was last modified, the mail address of the person that maintains the page and the Internet address of the page on a footer.

For the home page of the Web site,

12. Textual information should be minimized.
13. Any information not directly related with the organization should be placed outside the body of the page (the body of the page is the area between the header and the footer).
14. Pages should be short (should not require scrolling).
15. Links should be to primary aspects or characteristics of the organization.

Figure 4. Revised Set of Guidelines for Designing Usable World Wide World Pages

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