USER-CENTRED DESIGN OF A WEB INTERFACE FOR A BIBLIOGRAPHIC DATABASE ON WOMEN'S HEALTH

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Web usability design guidelines derived from a synthesis of the literature were used to evaluate two Web search interfaces for a bibliographic database on women's health information resources. The current interface is hosted on the Ontario Women's Health Council Secretariat website (OWHC). The OWHC is an agency of the Ontario Ministry of Health and Long-Term Care (Ontario, Canada). The new interface will be hosted on the Resources section of the Women's Health Matters (WHM) website, a bilingual Canadian consumer health portal on women's health issues. Six criteria for effective web interface design were identified: visual design; information architecture; navigation; search; universal usability, and help. Prior to conducting a literature-based evaluation of the two search interfaces, a series of evaluations were conducted with expert reviewers, IT experts and WHM content staff from Sunnybrook and Women's College Health Sciences Centre. Findings from both types of evaluation were compared and deemed to be similar. The current and future web search interfaces are aesthetically pleasing and offer standard search fields for conducting basic searches on the consumer health database. The OWHC search interface possesses one advantage over the prototype WHM interface; an alphabetically arranged list of health topics. However, the prototype WHM search interface offers more search options in both the basic and advanced search interfaces. Both the current OWHC search interface and prototype WHM interface suffer from inconsistency and/or lack of clarity in terms of labelling search fields and their options. Furthermore, the complexity of the WHM advanced search interface, in terms of number of search categories, impairs usability. Modifications to the prototype WHM search interface have been subsequently implemented by Women's Health Matters before the official launch of this consumer health database and its web interface on the WHM site in late 2003. Thus, two divergent methodological approaches can provide similar insights into effective web design and lead to improvements in the usability of web search interfaces.

Keywords: Web search interface; Web usability design; information architecture; expert reviews; consumer health information; women's health; Women's Health Matters

INTRODUCTION

The Ontario Women's Health Council database on women's health information resources is a bilingual (English-French) bibliographic database of health information resources produced primarily in Ontario over the past five years, but including records of information resources published elsewhere in Canada, the United States, and to a much lesser extent, other English and French-speaking nations around the world.

The database was originally developed to conduct gap analysis of existing information resources on women's health found in the public domain for a consumer scan on women's health issues requested by the Ontario Women's Health Council Secretariat, a division of the Ontario Ministry of Health and Long-Term Care [1]. A separate outcome of this project was the development of a web interface so that the database could be made accessible to the public and serve as a guide to consumer health resources on women's health issues.

Currently, the database is hosted on the Ontario Women's Health Council website. In 2001, the Council issued a request for proposals for the future development and ongoing maintenance of the database. The database requires ongoing development and maintenance because new information resources, in both print and electronic format, are continually being produced for public consumption. As well, more resources are being published in languages other than English and French, Canada's two official languages. Nowadays, information resources are released in multiple formats, most commonly print and electronic (PDF and HTML) formats, but also audiotape, videotape, and CD-ROM.

Women's Health Matters (WHM) is a bilingual Canadian women's health portal developed and maintained by Sunnybrook and Women's College Health Sciences Centre and the Centre for Research in Women's Health. Both institutions are affiliated with the University of Toronto (Ontario, Canada). The site (URL: www.womenshealthmatters.ca) was launched on January 21 2000 at the Women's Health Expo and Forum, an annual public event. Initially, the site comprised three content modules, referred to as health centres,

on osteoporosis, cancer, and cardiovascular (heart) health. The site has evolved to include additional content modules, as well as interactive components, such as discussion groups and quizzes. In 2002, WHM was successful in submitting a proposal to the OWHC Secretariat for a 5-year plan that will see the database migrate to the Women's Health Matters website and incorporate the existing WHM Resource Directory. The addition of a bibliographic database to this site is the latest step in its ongoing development and it is timely, as portal sites evolve to deliver database-driven content. Figure 1 illustrates the evolution of this site using screen captures of the homepage (top-left); the cardiovascular health centre (top-right); the LeClub homepage (bottom left); and a placeholder page for the Resource Database (bottom-right).

FIGURE 1 – WOMEN'S HEALTH MATTERS WEBSITE

Although the content of consumer websites such as Amazon.com is markedly different from the content of consumer health websites such as WebMD.com or Women's Health Matters, all web designers share a common desire to present their message(s) and/or product(s) within a user-friendly framework. Designing effective interfaces to support a diverse array of web users, in terms of their information needs; design preferences; cognitive, perceptual and physical abilities; ethno-racial identities, and technological backgrounds, is not an easy task. In fact, there is no one interface that represents the "ideal" web interface. [2] However, there are some general standards and principles that remain consistent, regardless of the purpose or audience of an interface. Evaluation based on Web usability guidelines is key to implementing user-centred design. Sites that are user friendly are better positioned to attract and retain a loyal group of users. According to web usability expert, Steve Krug (p. 43), "making the choices mindless is one of the main things that makes a site easy to use." [3]

METHODOLOGY

An extensive review of the literature on Web user-centred design was conducted for the purpose of identifying those elements that constitute an effective user-centred interface. Six elements of an effective interface are: visual design; information architecture; navigation; search; help, and universal usability. This concise list of design elements was used to evaluate both the current and future (prototype) search interfaces for the consumer health database on women's health information resources. Because Help features were not

available on the prototype WHM search interface at the time of evaluation, help and universal usability will not be discussed in this paper.

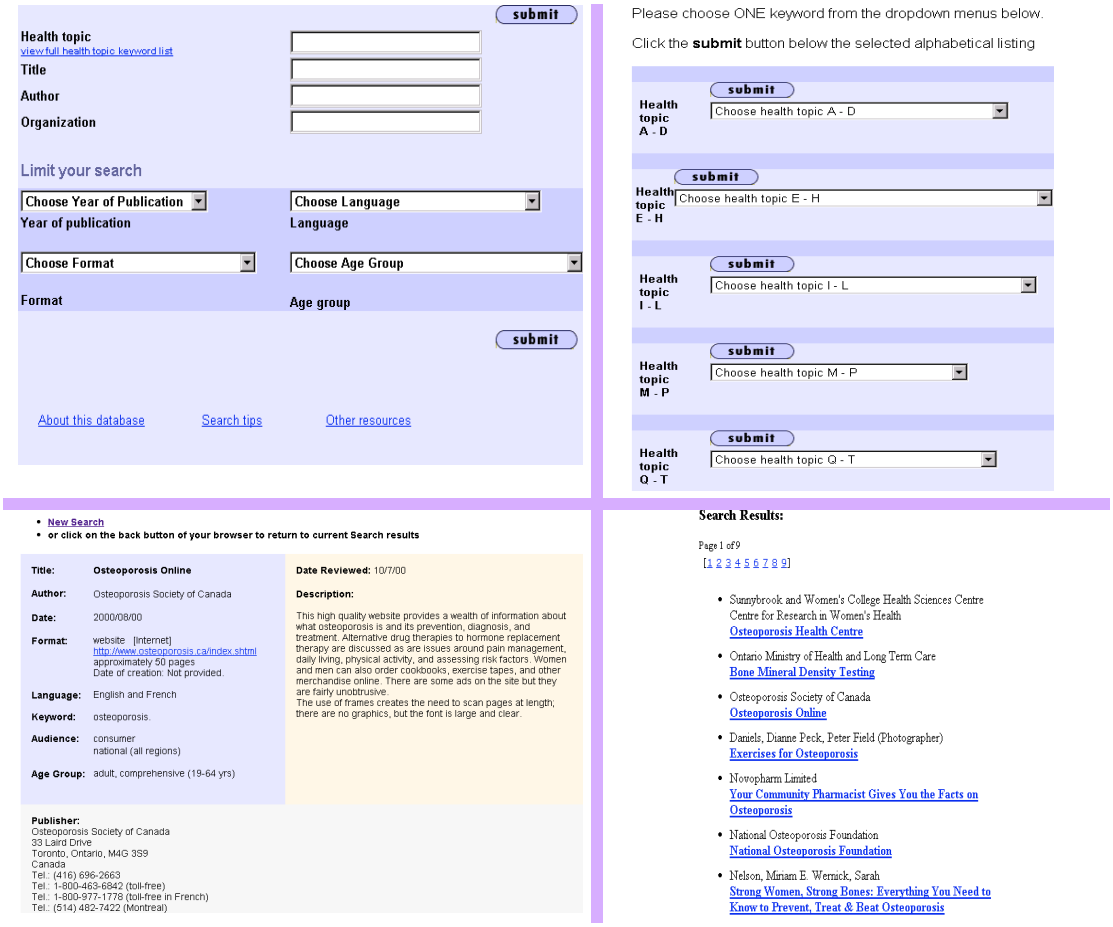

FIGURE 2 – OWHC SEARCH INTERFACE

The current search interface is located on the Ontario Women's Health Council (OWHC) website (http://www.womenshealthcouncil.on.ca/OWHC/Search.asp). Figure 2 illustrates the OWHC search interface pages, including, basic search (top left); keyword search list (top right); list of search results (bottom right), and a search result representing one database record (bottom left).

The future search interface will be hosted on the Resources section of the Women's Health Matters website (http://www.womenshealthmatters.ca/resources/index.cfm) in late 2003. During the evaluation period, the prototype was hosted on the web designer's site, at an undisclosed URL. Figure 3 presents the prototype (as of September 2002) of the WHM search interface pages, including, basic search (top left); advanced search (top and bottom centre); list of search results (top right), and a search result representing one database record (bottom right).

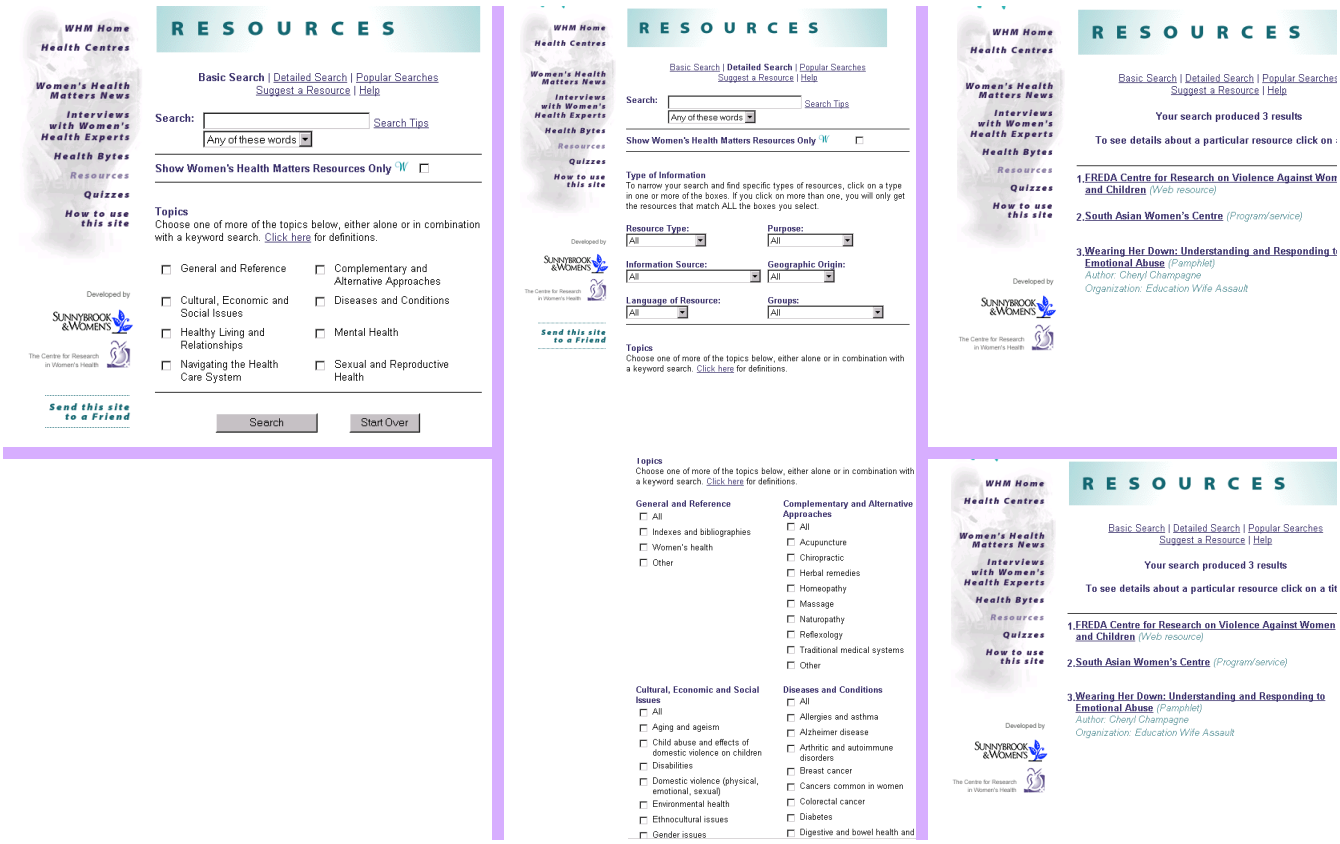

FIGURE 3 – PROTOTYPE WHM SEARCH INTERFACE

Both search interfaces, and their respective search results pages and database record pages, were evaluated according to principles of user-centred design derived from the literature review. Previously, several evaluation sessions were held in September 2002. First, an expert review session was conducted with IT experts from Sunnybrook and Women's College Health Sciences Centre and WHM staff in a focus group setting. This was followed by individual evaluations by master's students enrolled in LIBR548D: Foundations of Health Informatics at the School of Library, Archival and Information Studies (SLAIS), at the University of British Columbia, and a separate evaluation conducted by a research assistant at SLAIS. Findings from the literature-based evaluation of the Web interfaces were compared to comments from the expert review sessions and the two forms of evaluation are presented in the results section.

RESULTS

VISUAL DESIGN

Admittedly, assessing the aesthetic qualities of an interface is a subjective process. However, there are a number of variables that we identified to assist us in this process. According to Marcus, the use of color can enhance black and white information. In particular, blue should be used for large areas and backgrounds, while red and green, which tend to draw people's attention, are better suited in the centre of the visual field. [4] Furthermore, consistency and redundancy in the presentation of design elements are important aspects of visual design. [5,6,7]

The design of the OWHC and WHM search interfaces for the consumer health database communicate information using color. Both interfaces use web browser default link colors, purple and blue, and overall, maintain a consistent purple and white color scheme, which enhances the black textual information. The WHM search interface colors are those of the WHM site: purple, white and green/teal. A representative comment from the expert review session is: "I like it. I like the color, it's easy to understand." [Participant FS]

The OWHC search interface is very sparse in appearance and does not bear any resemblance to the OWHC website. The search fields are presented in black text on a white background while the limit fields are presented as drop-box lists on a purple background. Rather than add the OWHC design elements, such as logo and navigation bars, to the search interface, clicking on "Search for Health Information" from the OWHC homepage launches the search interface for the consumer health database in a separate browser window, as illustrated in Figure 4 below. It can be argued that the sparseness of the search interface enables the user to focus on the search tasks at hand. However, it is more likely that an intellectual property issue is responsible for this design decision. The OWHC is a government agency and the contents of the database are its intellectual property. A technical solution for protecting intellectual property in the Web environment is the use of pop-up windows, as searchers cannot download records from search results using the browser's Save function in this browser environment.

FIGURE 4 – OWHC HOMEPAGE AND SEARCH INTERFACE IN SEPARATE BROWSER WINDOW

Another element of visual design is appropriate page length (no more than 30,000 bytes) and page width of text and font size. [8] Both the OWHC and prototype WHM basic search interfaces meet this requirement. However, the Detailed Search on the WHM interface presents searchers with many search options, displayed as checkboxes, which adds greatly to the length of the webpage.

INFORMATION ARCHITECTURE

Textual and iconic labels and controlled vocabulary comprise the information architecture, narrowly defined, of a well-designed interface [9,10,11,12]. If the labels and navigational structure of a website do not support both novice and expert users, those users will experience an overload of their short-term memory and become disoriented. [13] Site designers must provide both semantic cues (for their novice users) and spatial cues (for their expert users).

Labels, a type of semantic cue, support the navigational path and informational needs of users. Both OWHC and WHM search interaces avoid the use of medical terminology in labelling search fields and their options. However, the use of standard terminology to label the features of the website is lacking on the WHM interface. For example, the WHM link to the feature that is commonly described on many web sites as "Advanced Search" is instead named "Detailed Search." As well, WHM's basic search interface is described both as "Basic Search" and "Keyword Search." Such inconsistency in labelling across and within a search interface fails to support the searcher in his/her quest for information. As one focus group participant states:

> Participant: (FS): ...it looks like the title is for this page but is not....And on another page, a basic search page, for me that doesn't make any sense....You have to start your level of organization here and it's a good [title]. And if you want, put a title for this page, as a main page it's a main page. If it's a basic search page you have to have a title of that page. For me, like it doesn't work.

The WHM Detailed Search interface is overly complicated in terms of the number of search limits and their layout, which could cause cognitive overload, as well as navigation issues, as noted by several expert reviewers.

> Participant (WF): Navigation's pretty good, the only place where I think you're going to have trouble with navigation is where you have all the check boxes, because there is a portion when you're scrolling down where there is no top of the page. You actually have to scroll [which is a] bummer.
>
> Participant (MT): I think if you could shorten somehow the topics, it is very long and I can't remember how scroll down works, you could only pick one, I guess if it's a scroll down... I do find that— [fairly lengthy] … drop-downs…, so that is fairly long, and I don't find that particularly appealing, but you know, choices that I guess need to be made..
>
> Participant (WF): There's an awful lot of geography taking up all the information, that's so unfortunate. All the way down to the bottom of resources is useless, the material, if I want to search for something, it's unfortunate, especially when you have so many choices on the advanced search topics. That's really valuable real estate.

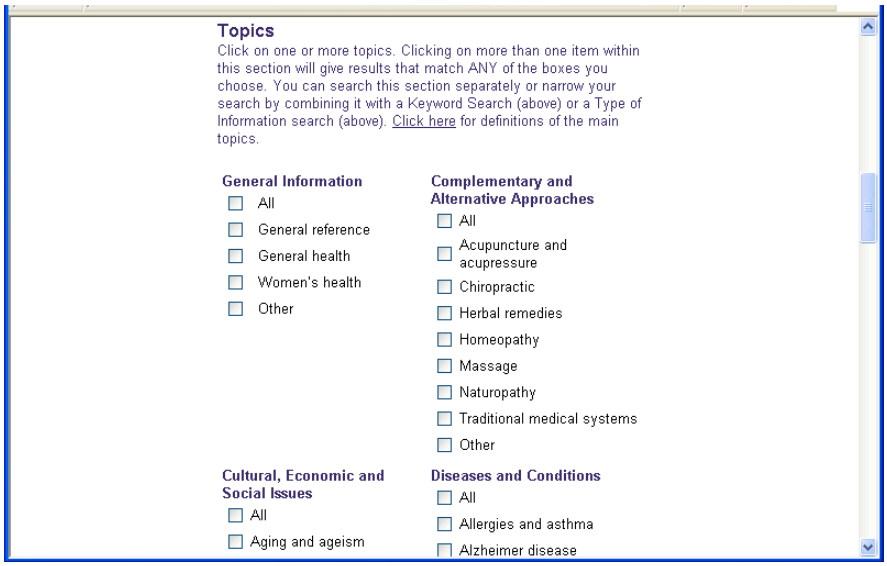

FIGURE 5 - PROTOTYPE WHM DETAILED SEARCH INTERFACE LIST OF TOPICS

The prototype WHM Detailed Search interface offers two ways in which to limit a search: "Types of Information" and "Topics." Specifically in "Types of Information," the textual label "Groups" is quite confusing: Does "Groups" mean ethnic groups? Age groups? Only when one clicks on the drop-down box does one understand that "Groups" represents "Age groups." However, within groups, the range of options for "Age groups" is not mutually exclusive.

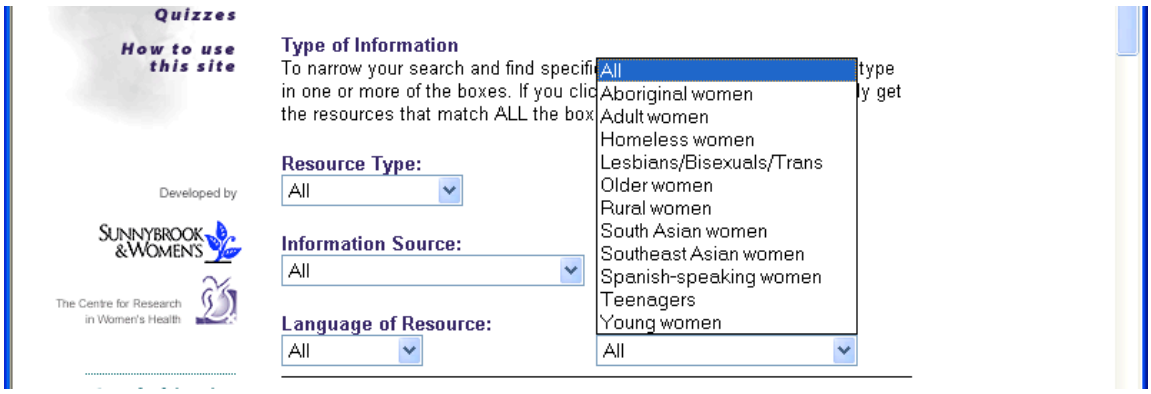

FIGURE 6 - PROTOTYPE WHM DETAILED SEARCH INTERFACE, GROUPS FIELD LIST OF OPTIONS

As an example, one wonders what option within "Groups" a searcher would chose if s/he is looking for information on adult aboriginal women? As well, what is the difference between "Adult women" and "Older women"? Such confusion continues in "Topics." Whereas the "Topics" list seems intuitive in "Basic Search," in "Detailed Search" the user is presented with all the options in "Cultural, Economic and Social Issues."

Another issue is the use of iconic labels on the search results page of the WHM search interface. For example, the Canadian flag and the official symbol of the province of Ontario are used to assist searchers in identifying the geographic location of the information. However, since these are official symbols, searchers may assume that the sources are authoritative, that is that the resources accompanied by these icons are published by the provincial or federal government.

> Participant (CL): I love that you say what it is and that you have little government symbols next to it. I think that's very immediate in expressing…on this information, you know its coming from the government. [laughter]
>
> Participant (WF): Actually, that's not what it means— it means that it's a Canadian resource or an Ontario resource but it could be a non-government.
>
> Participant (ALL): Then that's misleading...

In this situation, use of iconic labels is ineffective because it is subject to misinterpretation. It is imperative that the meaning of labels, whether they are textual or iconic, must be made/designed to be intuitively obvious to users because labels that convey multiple meanings may reflect poorly on the content of the web site.

NAVIGATION

There is consensus in the literature that if the users are unable to manoeuvre through a website, and successfully find what they are searching for, then the likelihood of continued searching and ongoing use of the website decreases. Navigation plays a significant role in this process and should be intuitive. [14,15,16,17] Users should be aware that support exists when they navigate through a website. [18] The interface design should provide meaningful paths and exits, including allowing reversible actions. In the literature, this concept is commonly known as "locus of control". [19] Mandel further suggests that the interface accommodate users of various skill levels and display descriptive messages and text (e.g., password cues). [20]

To enable ease of use, the amount of scrolling should be kept to a minimum; therefore, the important information should be placed near the top of the page. [21,22] Well-designed navigation bars contribute to the failure or success of a user's journey through a site. There are several types of navigation bars—each serving a particular function—that serve to guide users. Generally, navigation bars may be grouped into four main categories: top and/or sidebars, contextual bars, breadcrumb, and site navigation bars. [23] The British Columbia Cancer Agency's website provides an excellent illustration of the four types of navigation bars.

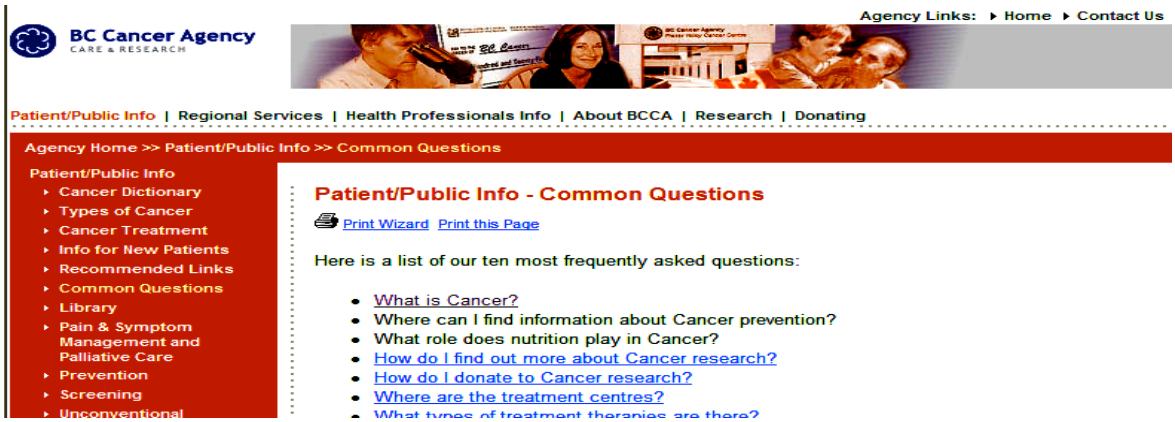

FIGURE 7 – BRITISH COLUMBIA CANCER AGENCY WEBPAGE

Top navigation bars (also referred to as "Global" or "persistent" navigation bars) must be consistent in appearance and location throughout the site. With the exception of the homepage and the pages where forms are located (e.g. registration or feedback forms), top navigation bars must be present on each page. Any navigation bar that is found on the top of each web page must include the following elements: a distinctive, easily recognizable Site ID (or logo), a link to the various sections (or pages) of the site, and links to the search engine, home page, and utilities (e.g. Help feature). [24]

Links are closely tied to navigation. The success of a link depends on two factors: how well the user is able to predict where the link will lead – descriptiveness, and how well the user is able to differentiate the link from other links – differentness. [25,26]

In addition to links, breadcrumbs are an important navigational aid. Reminiscent of the fairytale detailing the experiences of Grimm's Hansel and Gretel, site designers draw upon this well-known nineteenth-century literary example of physically marking one's path. Farnum (p. 38) describes a breadcrumb navigational aid as metaphorically "show[ing] the position of a page within a hierarchy or the path taken by the user." [27]

The OWHC search interface violates the principle of locus of control because it is presented in a separate browser window, seemingly divorced from the OWHC site. This arrangement may present navigational problems for some Web users because use of the Back button is disabled; instead, the user must return to the original browser window to access the OWHC site. Morever, the searcher cannot return to the previous search page using the Back button. The only option is to click on the link "New Search" located at the top of the records page. Within the search interface, links are provided from the primary search results page to subsequent search results pages. As well, links are provided in the search results page to every record retrieved. For Web-based information resources, the presentation of the database record on the search interface includes a link to the URL of the resource.

The prototype WHM search interfaces retain the top and side navigation bars found on all pages of the WHM site, thereby linking the search interface to the entire site. The WHM navigation features were evaluated before and after the launch of the WHM site in January 2000. Marton (p. 756) found that "participants requested more navigational aids including internal navigational links in each web page, better navigation from one page to another within a module, and content summaries" [28]

SEARCH

The key principle for designing search tools is simplicity. [29] Krug (p. 67) suggests designers follow a three-part formula "a box, a button, and the word 'search'". [30] Because the prototype WHM search interfaces were static pages at the time of the evaluation, assessing search efficacy and satisfaction was not possible. Evaluation was restricted to an examination of the physical layout and labelling of the primary search features, recognizing that these attributes may more appropriately be discussed under information architecture.

The OWHC offers four search boxes, one per search field, in the basic search interface, and two submit buttons, at the top and bottom right side of the search interface. In contrast, the WHM search interfaces provide only one search box, imitating the simplicity of the Google search interface. As one focus group participant notes,

> Participant (CL): I really like it, it's very clear to me. I like the fact that you got the search box front and centre.

The location of the search button is at the bottom of the search interface, instead of next to the search to the search box. Comments from focus group participants critiquing the location of the button concur with guidelines of user-centred web design:

> Participant (CL): One way I think you might get around that [making it clearer that the selecting a topic box is optional], just putting another search button next to the search box right away, so you don't even have to look down the page.

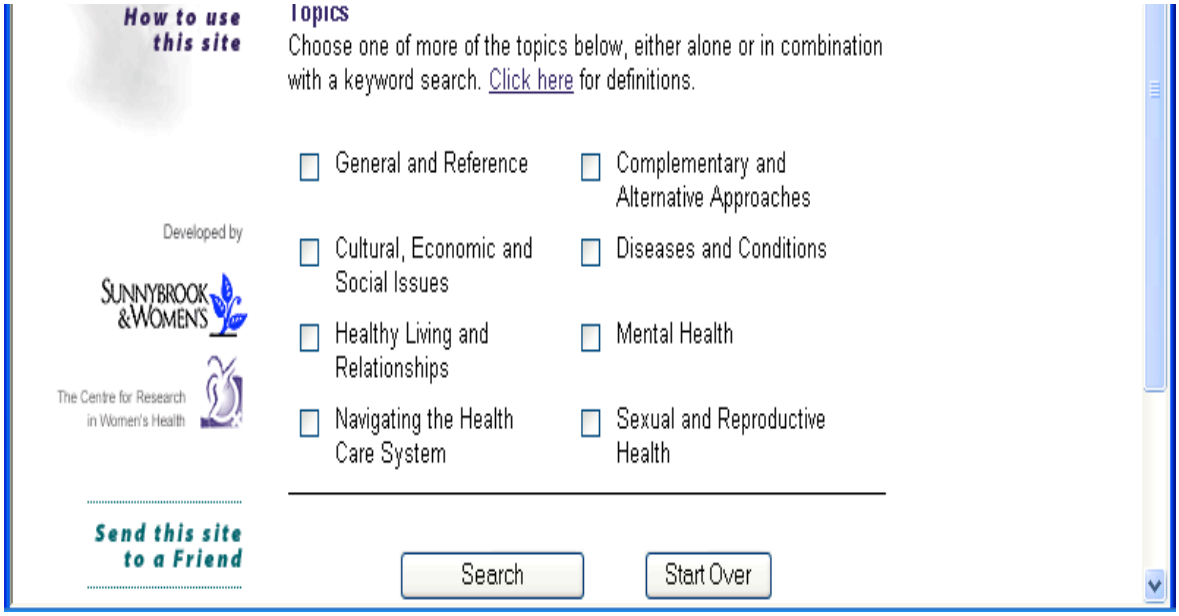

FIGURE 8 – PROTOTYPE WHM BASIC SEARCH INTERFACE WITH ARROW INDICATING THE LOCATION OF THE SEARCH AND START OVER BUTTONS

Another issue is the search option, "Search Women's Health Matters Resources Only" located beneath the search box. It is not clear what selecting this option entails; this requires explanation. Comments from expert reviewrs indicate confusion over this search option.

> Participant (AD): I guess since it's going to be part of the Women's Health Matters website, it may be nice for the lay person to know what kind of resources are going to be offered here. I am just saying resources, I don't know what that means, cause I think the place that I can go to, to get information, like physical location, or is it just abstract, is it, you know, research papers, like I don't really know what kind of resources I am going to be getting....like I really think that [if] this is for lay people, they should get a definition of what resources are, what it is, what does that mean.

DISCUSSION

Two types of evaluation were conducted to assess the usability of the current and future search interfaces for a bibliographic database on women's health information resources. Findings from both evaluations indicate the visual design of the prototype WHM search interface, its navigational elements, and search options offered in the Basic Search interface represent an improvement over the current search interface located on the OWHC site. While the prototype WHM search interface could benefit by the addition of a health topic keyword list similar to that found on the OWHC search interface, the layout of search box and the categories of health topics (biomedical and social determinants) available to refine the search query on the new interface meet web usability guidelines and were rated favorably by the expert reviewers. Overall, the prototype WHM Basic Search interface is user-friendly and achieves a balance between breadth (the number of options at each level of the hierarchy) and depth (the number of levels in the hierarchy) of information.

However, there are several shortcomings that must be remedied. The location of the "Search" button on both the Basic and Detailed Search interfaces should be next to the search box, instead of at the bottom of the search interface. The search option "Show Women's health Matters Resources only" requires clarification. Furthermore, the number of Topics on the Advanced Search interface must be reduced. As well, the labelling of several fields in "Type of Information" was found to be unclear or inappropriate.

CONCLUSIONS

A literature review on web usability led to the development of six elements of user-centred design. The present and future search interfaces of a consumer health database on women's health information resources was evaluated according to these attributes of web design. As well, evaluation sessions were conducted with expert reviewers in a focus group setting, followed by evaluations conducted by individual reviewers. Findings from these evaluations are used by the web designers of the new search interface to improve usability before the official launch of the search interface and its underlying database in the fall of 2003 at http://www.womenshealthmatters.ca/resources/index.cfm.

Shortcomings of this study are twofold: the prototype WHM search interface pages were static webpages; reviewers could not conduct actual searches to test attributes of search success such as relevance and user satisfaction, and secondly, expert reviewers participated in these evaluations, instead of women from the general public. However, the next phase of evaluation research will remedy these limitations. A web survey will be hosted on the WHM site in the fall of 2003. The focus of the survey is to understand user impressions of the WHM search interface and satisfaction with the search process. Interested readers are invited to complete the online questionnaire or e-mail their feedback to the authors.

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