

Finding and Exploring Health Information with a Slider-Based User Interface

Patrick Cheong-Iao PANG, Karin VERSPOOR¹, Jon PEARCE and Shanton CHANG

*Department of Computing and Information Systems,
The University of Melbourne, Melbourne, Australia*

Abstract. Despite the fact that search engines are the primary channel to access online health information, there are better ways to find and explore health information on the web. Search engines are prone to problems when they are used to find health information. For instance, users have difficulties in expressing health scenarios with appropriate search keywords, search results are not optimised for medical queries, and the search process does not account for users' literacy levels and reading preferences. In this paper, we describe our approach to addressing these problems by introducing a novel design using a slider-based user interface for discovering health information without the need for precise search keywords. The user evaluation suggests that the interface is easy to use and able to assist users in the process of discovering new information. This study demonstrates the potential value of adopting slider controls in the user interface of health websites for navigation and information discovery.

Keywords. Consumer Health Information; Exploratory Behaviour; Hypermedia

Introduction

Search engines are the primary mechanism for finding health information on the Internet, but they are not necessarily the best tools for this purpose. Among the 72% of Internet users who consult online health information, 77% of them use search engines for accessing the information [1]. In spite of their popularity, research has found a number of issues associated with their use for searching for health information. Laypeople often do not possess the knowledge to describe the health queries in appropriate language [2]. In addition, search engines are mostly designed for general queries and the search results do not consider the characteristics of health information seeking [3].

Health information seeking is different from searching for general topics in many ways. It is often linked to uncertainty and stressful mental states [4][5], and therefore the search becomes more exploratory in nature [6]. Meanwhile, the literacy levels of users affect the outcomes of health information seeking [7][8]. Also, many people wish to make informed decisions for health conditions and thus use health websites for exploring extra information [9][10]. This diversity adds complexity to the design of consumer health websites for supporting such distinct needs and characteristics.

¹ Corresponding Author: Associate Professor Karin Verspoor, Department of Computing and Information Systems, The University of Melbourne, Parkville VIC 3010; E-mail: karin.verspoor@unimelb.edu.au.

In previous studies, we have learnt that health information seekers often adopt an exploratory search approach to look for information. They perform exploratory search when they are not familiar the search topics [11], are not sure how to search [12], or only have a rough idea about the search targets [13]. Seekers investigate and study the encountered information, in addition to simply locating it during exploratory search [14], and these elements need to be supported with special user interface (UI) designs.

In this paper, we present a novel slider-based user interface for facilitating exploratory search of health information. The use of sliders allows users to discover information within a health website without the need to issue search queries. This UI concept relieves the difficulties of using search keywords in health searches, and supports information exploration by exposing different perspectives on the underlying health information. The evaluation results indicate that this UI is able to assist users in the search process and has the potential of being adopted in health websites for navigation and information discovery purposes.

1. Related Work

Exploratory search is one of the different search approaches used in health information seeking [15]. Exploratory search is a type of search in which information seekers actively interact with information systems to retrieve a wider range of information [12][14]. For this purpose, seekers look for the information they need to know, learn from the information and investigate the potential directions for subsequent searches [14]. Exploratory search is different from traditional focused search, which aims at targeted information and is conducted with precise search keywords. As such, special strategies and user interfaces are needed for supporting exploratory search [11][12].

Exploratory search is highly relevant to health information seeking in many scenarios. People tend to be exploratory when they are not deeply familiar with the search topics and not sure how to search [11][12]. This is common in health information seeking, as people are often unable to express search queries using medical terminologies [2], or they do not have a clear diagnosis to start with [15]. Exploratory search is also useful when seekers try to address unfamiliar and unknown problems [11], such as health problems. Moreover, due to concerns about the veracity and relevance of online health information, seekers prefer to explore multiple information sources to verify information [15]. In brief, exploratory search is a crucial part of health information seeking; it is important to support this need in consumer health websites.

2. Website Design

We have proposed a design for consumer health websites that addresses the difficulties of keyword search and supports exploratory search [3]. The implementation of this design is called Better Health Explorer (BHX). BHX uses a slider-based user interface to facilitate information exploration with an interactive and engaging experience.

The new user interface is embedded in a conventional health website and is placed next to the content. The goal of this project is to explore possibilities for improving health information seeking, rather than eliminating search engines. Users can still use search tools such as Google and Medline Plus to find health information in a broader

scope, for instance the entire Internet. Our tool provides an additional mechanism to discover contents within the scope of the current website.

Figure 1 shows a screenshot of BHX. Each slider allows the user to explore changes along a spectrum of settings between two distinct attributes. When users adjust the sliders to represent their preferences, the information matching the slider values is shown on tiles and the movement of these tiles is animated on the screen. This animated visual feedback is important to convey the evolution of the exploration and to engage with the users. This keyword-less approach can reduce the cognitive load of finding health information.

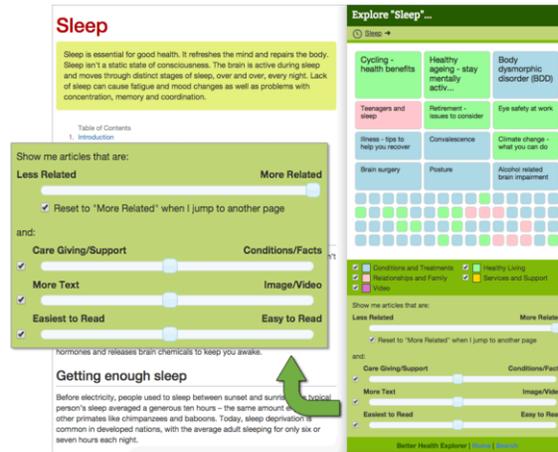


Figure 1. The user interface of Better Health Explorer. The sliders are enlarged on the left, for clarity.

2.1. Slider Setup

Since multiple dimensional inputs are often used to support exploratory search [11], we have selected four dimensions of health information for the exploration with sliders (as shown at the enlarged part of Figure 1). These dimensions were drawn from the findings and feedback of the participants in previous work, including the types of health information often being searched [15][16], as well as the understanding of health information seeking behaviours [6][7][8]. In addition, these dimensions are hard to express directly in a keyword-based search and it is difficult to apply these criteria to traditional search engines. Details of these dimensions are discussed as below.

Relevance to the current context: This dimension enables exploration in terms of the relevance to the current focus article. The slider is set to “More Related” by default, which aligns with the fact that seekers usually need to access information relating to the current topic. On the other hand, seekers sometimes need to access less related content for exploring the information in a broader manner. This is particularly useful when users have little idea what the complications or related information could be. In this case, users can adjust the slider towards “Less Related”, and explore a new set of tiles appearing on the screen. The movement of the slider brings information that is potential interesting to the user. Search engines are unsatisfactory in this case as they require at least some keywords for query suggestions. The related link sections in some

websites can achieve similar but those are often static content; whereas users can discover the site with more control with sliders, resulting in getting more information.

Care giving/support – Condition/facts: The nature of health information lies in different categories. Some information is fact-based description of health problems, but some is care-giving procedures for supporters. Health information seekers often need different categories of information for different circumstances. This slider enables health information exploration within a defined subset of the entire database in situations where the search scope would be difficult to specify with search engines.

Text – Image/Video: People have preferences for the types of media used to convey health information. Some people are more comfortable reading lengthy text, while others prefer less text and more images [3]. Additionally, articles with images are easier to comprehend in certain cases. This slider provides a mechanism to include this preference in the health information seeking process, as a result the website can deliver information that suits the preferences and requirements of the user.

Readability: Health website users show a mix of levels of reading abilities, and such abilities affect the user experience of consumer health websites. Particularly, users with poor literacy might have difficulties in understanding health information presented in a technical or professional manner [7][8]. This slider encourages users to explore the content that matches their reading abilities and allows the website to return appropriate content for the user.

2.2. Information Tagging and Matching

Health information, which is stored as articles in our system, must be analysed with an “information tagging” process for use with the sliders. This process generates scores for the dimensions discussed above for each article. This is similar to the indexing process of search engines but captures distinct attributes. Below we briefly explain the algorithms used for tagging the articles.

Relevance: Relevance scores are computed between pairs of articles, since relevancy is determined relative to the active focus article. This is different from the strategies used in information retrieval in which the relevancy judged with respect to a search query [17]. In this work, we use a number of factors and heuristics to determine the relevance between a pair of articles, including:

The number of words in common: We calculate the number of common words in a pair of articles after eliminating the stop words. The more words the articles have in common, the stronger their connection.

The number of hyperlinks in common: Similarly, hyperlinks contribute to the relevance between two articles. If there are more hyperlinks connecting to common targets, or the pair of articles mutually link to each other, we assess a greater relevance.

The categories that both articles belong to: Each article was assigned a category manually by the author. If articles are placed in the same categories, they are determined to be more relevant to each other.

The number of common keywords: The authors of the original articles assigned keywords to describe the content and make articles searchable. A higher number of common keywords reflects a greater number of topics shared by the articles, and thus represents a higher relevance.

The information provider: A number of information providers are represented in the health information in our database. These providers usually are organisations or

specialists of certain diseases (e.g. Diabetes Australia). Articles from the same provider are considered more relevant to each other.

Care giving – Condition: For this dimension, we adopt a heuristic strategy based on measuring the occurrences of specific key words in the body text. For example, words such as “caring”, “managing”, “family” suggest care giving articles, whereas articles with words like “treatment” are likely fact-based articles.

Text – Image/Video: For the scores in this dimension, we compute the number of words and images in articles. Articles with more words are put to one end of the slider, and articles with more images are placed to another end of the slider.

Readability: We use the Flesch-Kincaid readability formula to measure the reading difficulty level of the content [18]. This is a common method of testing readability of general English text, but it is not specifically designed for health/medical content.

Each slider contains 21 possible ratings numbered from 0 to 20. After generating the scores of articles, the tagging algorithm sorts the data and evenly distributes all articles amongst the 21 ratings. In this arrangement, each slider rating has a similar amount of associated articles. This design is to ensure that an article has a fair chance for displaying on the screen; otherwise, the chance would be affected by the number of articles mapped onto a single slider rating.

As the user modifies the settings of the sliders, an information matching process retrieves articles that match the settings, based on a two-stage model. First, the software retrieves a list of articles of the selected relevance value. This limits the information scope within certain range of relevance to the current article. Then, we calculate the cosine similarity values of the slider settings and the retrieved relevant articles, where the tagged scores of the articles on the 3 other dimensions are compared with the slider values. The comparison result is sorted by similarity value in descending order and displayed on the screen. This method aims to discover information that best matches with the composition of all user preferences as specified through the sliders.

3. User Evaluation and Discussion

We recruited 31 participants (15 males and 16 females, mainly from the university via mailing list and flyers) to test the slider-based UI. Their mean age was 33.9 (SD=12.67) and ranged from 20 to 72. They needed to find health information for four search tasks given to them. These search tasks included two focused and two exploratory search tasks. We conducted semi-structured interviews after each search tasks to gather feedback about the UI. Interviews were recorded and transcribed for analyses. For more details see [19]. According to their verbal feedback, the participants found the novel UI intuitive and easy to use, and they could complete the search tasks successfully.

The slider-based design received some positive feedback from the users. First, the slider encouraged exploring; as one participant said, *“I would like to explore the options, see what kinds of options come up on the screen... if I found something interesting, I gonna open it”*. Another suggested that the UI gave *“choices rather than just coming up with top things (in the search result)”*, and a further one reported that *“(the UI was) giving me new stuff that might be interesting”*. However, the UI was not suitable for every scenario, for example, one commented *“if you know what’s going on, you just go to search and see.”*

The evaluation shows that our design is significantly useful when the user has few clues about the search target. Users can drag the sliders and observe the appearance of

suggested health information. This requires less cognitive effort compared to other search tools, in which users have to type a few words to activate keyword suggestions.

4. Conclusions and Future Work

This paper has presented the implementation of a slider-based UI for exploring and discovering information in health websites. In cases of having unfamiliar health issues or facing new health circumstances, exploratory search is a better approach to making use of online health information. A preliminary study shows that the slider-based UI design allows better access to health information in exploratory scenarios.

We will continue to evaluate and optimise the design. We acknowledge that the algorithms used for tagging information are simple and based on existing annotations in the source data. Future research could experiment with other methods of classifying information into different dimensions that could also be reflected in sliders. Additionally, more in-depth studies could be carried out to further evaluate the UI in terms of usability, performance and user experience.

References

- [1] S. Fox and M. Duggan, "Health Online 2013," 2013.
- [2] A. Keselman, A. C. Browne, and D. R. Kaufman, "Consumer health information seeking as hypothesis testing," *J Am Med Inf. Assoc.*, vol. 15, no. 4, pp. 484–495, 2008.
- [3] P. C.-I. Pang, K. Verspoor, J. Pearce, and S. Chang, "Better Health Explorer: Designing for Health Information Seekers," in *Proceedings of the Annual Meeting of the Australian Special Interest Group for Computer Human Interaction (OzCHI'15)*, 2015, pp. 588–597.
- [4] J. D. Johnson and D. O. Case, *Health information seeking*. New York, NY: Peter Lang, 2012.
- [5] T. D. Wilson, "Information behaviour: an interdisciplinary perspective," *Inf. Process. Manag.*, vol. 33, no. 4, pp. 551–572, 1997.
- [6] P. C.-I. Pang, K. Verspoor, S. Chang, and J. Pearce, "Conceptualising health information seeking behaviours and exploratory search: result of a qualitative study," *Health Technol. (Berl.)*, vol. 5, no. 1, pp. 45–55, 2015.
- [7] E. M. Agree, A. C. King, C. M. Castro, A. Wiley, and D. L. Borzekowski, "'It's Got to Be on This Page': Age and Cognitive Style in a Study of Online Health Information Seeking," *J. Med. Internet Res.*, vol. 17, no. 3, p. e79, Mar. 2015.
- [8] M. K. Lam and L. T. Lam, "Health information-seeking behaviour on the Internet and health literacy among older Australians," *Electron. J. Heal. Informatics*, vol. 7, no. 2, 2012.
- [9] D. O. Case, *Looking for Information: A Survey of Research on Information Seeking, Needs, and Behaviour*. Lexington: Academic Press, 2002.
- [10] S. D. Lambert and C. G. Loiselle, "Health information seeking behavior," *Qual Heal. Res.*, vol. 17, no. 8, pp. 1006–1019, 2007.
- [11] J. Pearce, S. Chang, G. Kennedy, R. B. W. Ely, and M. Ainley, "Search and Explore: More Than One Way to Find What You Want," in *2012 Australian Computer-Human Interaction Conference (OzCHI'12)*, 2012, pp. 469–478.
- [12] R. W. White and R. A. Roth, *Exploratory Search: Beyond the Query-Response Paradigm*. San Rafael, CA: Morgan and Claypool, 2009.
- [13] W.-T. Fu, "From Plato to the World Wide Web: Information Foraging on the Internet," in *Cognitive Search: Evolution, Algorithms, and the Brain*, J. Lupp, Ed. Cambridge, MA, USA: MIT Press, 2012, pp. 283–299.
- [14] G. Marchionini, "Exploratory search: from finding to understanding," *Commun. ACM*, vol. 49, no. 4, p. 41, 2006.
- [15] P. C.-I. Pang, S. Chang, J. Pearce, and K. Verspoor, "Online Health Information Seeking Behaviour: Understanding Different Search Approaches," in *Proceedings of the 18th Pacific Asia Conference on Information Systems (PACIS 2014)*, 2014.

- [16] H. K. Andreassen, M. M. Bujnowska-Fedak, C. E. Chronaki, R. C. Dumitru, I. Pudule, S. Santana, H. Voss, and R. Wynn, "European citizens' use of E-health services: a study of seven countries," *BMC Public Health*, vol. 7, p. 53, 2007.
- [17] R. Baeza-Yates and B. de A. N. Ribeiro, *Modern information retrieval*. New York, NY: Addison-Wesley Publishing Company, 1999.
- [18] J. P. Kincaid, R. P. Fishburne Jr, R. L. Rogers, and B. S. Chissom, "Derivation of new readability formulas (automated readability index, fog count and flesch reading ease formula) for navy enlisted personnel," *Nav. Tech. Train. Command Millingt. TN Res. Branch (No. RBR-8-75)*, 1975.
- [19] P. C.-I. Pang, S. Chang, K. Verspoor, and J. Pearce, "Designing Health Websites Based on Users' Online Information Seeking Behaviours: A Mixed-method Observational Study," *J. Med. Internet Res.*, 2016.