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Search User Interface Design for Children: Challenges and Solutions

Tatiana Gossen
Faculty of Computer Science,
Otto-von-Guericke-University,
Germany
tatiana.gossen@ovgu.de

Marcus Nitsche
Faculty of Computer Science,
Otto-von-Guericke-University,
Germany
marcus.nitsche@ovgu.de

Andreas Nürnberger
Faculty of Computer Science,
Otto-von-Guericke-University,
Germany
andreas.nuernberger@ovgu.de

ABSTRACT

In this paper we describe the main challenges in designing search user interfaces for children. Young users require emotional support, language support, memory and cognitive support, interaction support and support to judge document relevance. We discuss possible solutions for each challenge. We also present a working prototype of a web search interface whose main target group are users of primary school age. Our interface is colourful and voice supported, contains possibilities for both searching through text input and browsing in menu categories, has a guidance avatar for emotional support and a result storage functionality to support children's cognitive recall.

Keywords

Web Search Engine, Children, Search User Interface.

Categories and Subject Descriptors

H.3.3 [**Information Storage and Retrieval**]: Information Search and Retrieval.; H.5.2 [**Information Interfaces and Presentation**]: User Interfaces.

General Terms

Design, Human Factors, Management.

1. INTRODUCTION

In times of digital natives more and more children are going online. According to a recent report [8], children of ages five to nine spend about 28 minutes online daily and this time continuously grows. The German 2010 KIM[1] study [17] reports that about 60% of the German children of ages six to thirteen use the Internet and 70% of those use search engines. Children are using the Internet for different purposes, especially for entertainment like online games or watching videos on *Youtube*, for communication and for information search, e.g. related to their school activities [17].

In the modern society, finding information in the Internet is an important skill that a child needs to develop. If a child succeeds in finding the information, it feels competent and develops self-confidence. In contrast, if it is not able to find good results, a child may develop a feeling of incompetence. That could even lead to a feeling of inferiority, especially in the "industry versus inferiority" period of child's psychosocial development (age 6–12) [5]. Children's immaturity in the emotional domain is not the only aspect that is different from adult users. Children's cognitive abilities are also not fully formed [21]. Thus, children do not have the same abilities and knowledge as adults and constitute a separate user group. The special characteristics of children are challenging and should be considered by the development of web search engines, including the design of web search user interfaces (UIs).

In order to support children in their search, special search engines for children, have been launched, e.g. *kidrex.org*, *onekey.com*, *askkids.com*, *kidsclick.org*, *dipty.com*, *blinde-kuh.de*, *fragfinn.de*, *helles-koepfchen.de*, *quinturakids.com* etc. Currently, their main purpose is helping children to find *only* child appropriate content in the WWW. Another important aspect is the usability of those search engines. It is of importance that search engines for children match the particular skills of children in order to increase their usability for children. Unfortunately, current search engines for children not always match the skills and abilities of children [6].

The aim of this work is to develop a novel web search UI which meets the needs of children, i.e. fits their cognitive abilities, knowledge and provides the necessary emotional support. This interface should support children in their search in a web document collection. Our primary focus is textual information retrieval, as web documents mostly have a textual form and are written in natural languages. When designing tools for children, there is a need to target very narrow age groups [19]. Cognitive abilities and knowledge of a fourteen years old and a seven years old child strongly differ. In this paper we concentrate on primary school age children as in our opinion this user group is the most challenging one. In the following we underline challenges in the design of web search user interfaces for young users and present possible design solutions.

2. DESIGN CHALLENGES & SOLUTIONS

Emotional Support: Based on Erickson's theory of psychosocial development [5] children require emotional support and a feeling of success. This can be achieved by proper guidance. The idea here is to provide children with enough help to support their search process in order to avoid frustration. We propose building a guidance avatar that captures children's failures, e.g. getting no results or spelling mistakes, and explain how to do better.

[1]KIM is a German acronym for Children and Media ("Kinder + Medien, Computer + Internet"). It is a German user study which is regularly conducted in the form of interviews.

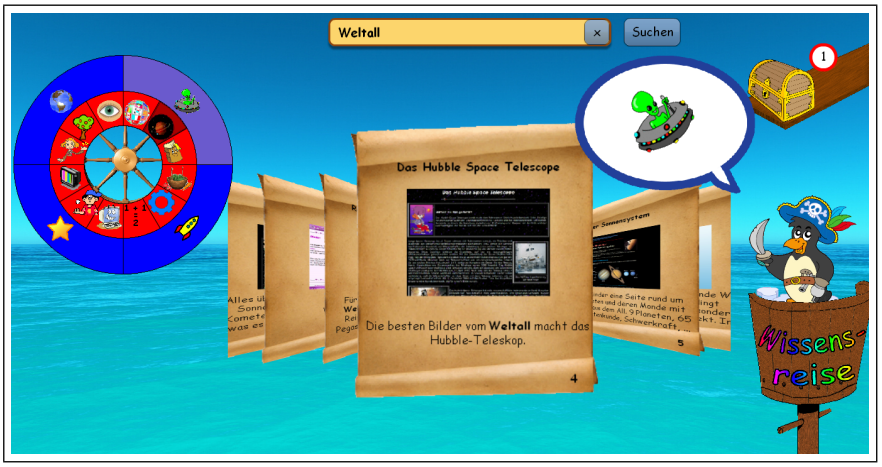

Figure 1: Screenshot of the *Knowledge Journey* user interface: a guidance figure and a treasure chest on the right hand side, query input elements on the top, a menu with many categories on the left hand side and a coverflow with search results in the middle.

Language Support: Children, especially in the primary school age, read slowly and are still learning to write [23]. In addition, children have a limited domain knowledge [11] and difficulties with typing using a keyboard [22]. This results in problems with query formulation and spelling errors [2, 7]. Therefore, a search UI for children should provide different possibilities for children to formulate their information need. We suggest using a browsing menu with many categories which meet children's information needs. This menu should be image based and audio supported in order to navigate ergonomically and fast within it. Besides the browsing, we also suggest to provide the opportunity of keyword-oriented search supported by spelling correction mechanisms. Children can choose the way they want to start searching. With an increasing domain knowledge (possibly gained from browsing in categories) children can employ keyword-oriented search more efficient.

Cognitive Support: According to theories of human cognitive development, human development occurs in a sequential order in which later knowledge, abilities and skills build upon the previous ones [20]. Piaget [21] describes four development stages. Children in primary school age are in the concrete operational stage of their development which is characterized as a stage where children learn to reason logically and have difficulties with thinking abstractly. Their understanding is limited to concrete and physical concepts. Therefore, categories used in the menu should not be abstract and browsing menu should have a flat hierarchical structure. Metaphors used in the user interface should be familiar to children and have a connection to the physical world (this is also advised in [3]).

Memory Support: According to the information processing theory [13], information processing of children differs from the adults' in terms of how they apply information and what memory limits they have, i.e. children can represent and process less information than adults. Information retrieval processes may cause children's memory to overload. This explains children's "looping" behaviour during the information seeking process. Children click, repeat searches and revisit the same result web page more often than adults do [2, 7]. To support children's cognitive recall we can provide a result storage functionality. It is also important to show a clear back-button or just present the search result in the same window (e.g. using frames) in order for children not to get lost.

Interaction Support: The information processing rate influences the fine motor skills of children [4, 10]. Young children's performance in pointing movements, e.g. using a mouse, are lower than that of adults. Therefore, the search user interface should prefer simple point-and-click interactions and clickable interface elements should be large enough to be easily hit [3].

Relevance Support: Children also have difficulties to judge the relevance of the retrieved documents to their information need [12]. Children are frustrated by too many results and do not have the ability to determine the most relevant and "best" documents [14]. A child-suitable form of results presentation can support children's judgement of results' relevance and provide relevance clues. Each result item should have a website image and its description. Akkersdijk et al. [1] also suggest displaying the results using a *Coverflow* technique where the user navigates horizontally. Coverflow allows users to concentrate on one item at a time. It also does not require complex interactions like scrolling as a vertical results list used in common search engines.

3. SEARCH INTERFACE

We considered the requirements for user interface design and developed a search user interface for children called *Knowledge Journey (KJ)*. We used multimedia elements in the UI design to make the appearance attractive for children. We also took into account that all clickable items are of appropriate size. We used font sizes larger or equal to 14 pt as advised in [3].

Our search user interface KJ uses the metaphor of a treasure hunt where a user takes a journey to gather relevant search results. The interface of KJ is shown in Fig. 1. It consists of five groups of elements: a guidance avatar (here a penguin pirate), a treasure chest, a coverflow, elements for keyword search and a pie-menu for browsing. In the following we are going to describe each element group.

3.1 Guidance Avatar

In order to start a "Knowledge Journey" a child selects a guidance avatar (see Fig. 2a). The avatar concept is familiar to children from computer games. It allows individual user personalization, e.g. girls can select a female pirate or penguin, there are also figures for younger and older users. The guidance avatar supports children's search process in order to avoid frustration: in the current version it supports children by providing a spelling correction after a misspelled query is submitted (see Fig. 2b) and enlarges images of menu categories providing animations (Fig. 1). A further possible function of the guidance avatar is an explanation how to search and what to do in case of finding no results.

(a)

(b)

Figure 2: Screenshot of the user interface: select which pirate accompanies you by the *Knowledge Journey* (a) and guidance avatar makes a suggestion by a misspelled query (b).

3.2 Browsing Menu

In order to support children who have difficulties to formulate a query, a browsing menu with many categories is designed. There exist different types of menus. We used a pie menu as it can be operated with simple point and click interactions and presents a good overview of categories. The pie menu is placed on a steering wheel. We use the metaphor that a steering wheel is used to define the search coordinates to provide a search direction. Initially top categories of the menu are shown (see Fig. 3, middle). We choose menu categories like entertainment, sports and hobbies, history, universe, geography, nature, persons etc., as they meet the information needs of children described in [16]. Each category has a number of subcategories. Children are comfortable to use a two-level hierarchical organized menu for browsing [11]. Corresponding subcategories are opened when a child clicks on a top category.

Mousing over the category triggers an action of a guidance avatar, i.e. it shows a large animation to explain the category. Icons and animations are used to indicate categories because images better match the cognitive skills of children than written words [9]. They also make the user interface more attractive for children as they prefer colourful designs with multimedia content [18, 15, 3]. In addition, we provide voice support. By placing a mouse long enough on the pie menu item, a voice explanation is played telling what category is selected. Users can also hide the menu by clicking in the middle of it. Then, only the wheel is shown (see Fig. 3, left). The menu can be opened again by clicking on the wheel. If a child clicks a category it receives results visualized as a coverflow. The category name is also placed as a text in the search input field.

3.3 Results Presentation

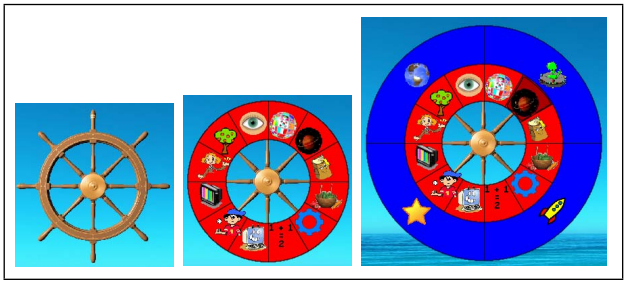

Figure 3: Screenshot of the user interface: browsing menu on a steering wheel in three different levels (closed, opened, opened with 2nd hierarchy level).

The result presentation is shown in Fig. 1. We use a coverflow where each item is presented on a papyrus roll that contains the webpage's title on top, its thumbnail (preview) in the middle, a textual summary and a result number according to the relevance on the bottom. A child can interact with our coverflow using simple point and click operations. It can open a webpage by clicking on the result item that is in focus or switch to the next or previous page by clicking on an item that is not in focus. The whole papyrus roll area is clickable and thus it is easy to hit.

When designing a search UI for children, search results and links should not be opened in a new window or tab as this inhibits backtracking with the browsers' back button and thus provokes "looping" behaviour. Users can easily get confused or lost and start searching for the way back. We decided to open a webpage in the same window using a frame (see Fig. 4). In order to return to the search a child clicks on the "X"-Button. It can also store a webpage using a "+"-Button.

3.4 Results Storage

A child can store relevant results in the "treasure chest". This form of storage aims to support children's memory to prevent cognitive overload. The number of stored results is shown near the chest. Furthermore, we use physical concepts like the size of the chest to show the amount of "treasure", i.e. a chest icon becomes larger with each additional stored result (compare Fig. 1 and 5). By clicking on the chest, a journey journal opens (Fig. 5). We use a book metaphor, where each reversal of the book contains information about a stored webpage: its thumbnail, a textual summary and a title. A child can add notes to each website. It can also open the website again by clicking on its picture in the book. If a child does not like a website anymore, it can delete it by clicking on the

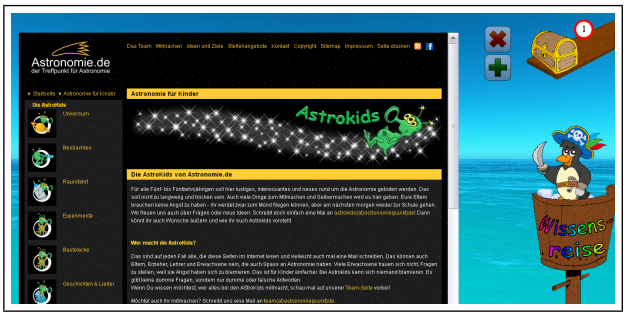

Figure 4: Screenshot of the UI: website opens in a frame.

Figure 5: Screenshot of the user interface: journey journal with favourite web pages.

"-"-Button. Tiles in the form of small website thumbnail (below the journal) are used to navigate within the book.

4. DISCUSSION & OUTLOOK

In this paper we described the challenges when designing search user interfaces for children. We demonstrated possible solutions based on which a novel user interface, called *Knowledge Journey*, was designed. We presented the user interface elements of KJ, i.e. a guidance avatar for emotional support, a treasure chest for memory support, a pie menu for language support and a coverflow to support the judgement of results relevancy. The interface also uses simple interactions to support children's fine motor skills. A comparative user study with 28 young users of age seven to twelve (average 9.5 years) was conducted where we compared our user interface with a *Google-like* UI. We evaluated what features of both interfaces children like most or do not like and the results are promising, i.e. 17 participants preferred KJ interface and five liked both. In the future we are going to do a deep analysis of the study results in order to improve the interface.

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