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Meet Me in the Library!

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Abstract

This paper discusses the topic of social interaction in the field of information-seeking. With our design of the "search tokens", we suggest a new hardware setting and a novel tangible and multi-touch based user interface to support users in their information-seeking process and enabling co-located, collaborative knowledge work. We showcase our design with a scenario of a media library, presenting movies as information objects on a zoomable information landscape.

Introduction

Many theoretical approaches expose the importance of social interaction within a user's information-seeking process [1], [2]. These models describe several forms of social information exchange during the steps of information-seeking between various persons like colleagues, students and tutors.

However, from the perspective of today's digital information systems, such social interaction is not well supported. Besides theoretical information-seeking models not being considered well enough, an important reason for the existing flaws is associated with the hardware that is commonly provided to users of information-seeking systems. These are often based on single-display desktop workstations, controlled by mouse and keyboard and thus suffer from very restricted possibilities for co-located collaboration, allowing only one person at the time to interact.

Therefore, we introduce a novel concept to apply social information-seeking by considering an alternative hardware setting as well as a visual and tangible user interface. Our "search tokens" are specifically designed to support co-located collaboration and can be applied to many different scenarios that involve information-seeking. Furthermore, our design is based on the insights of the theoretical models mentioned above.

According to the literature, tangible user interfaces (TUIs) [3] as well as the multi-touch technology [4] are suitable concepts to support co-located collaboration. In contrast to mouse and keyboard they allow several

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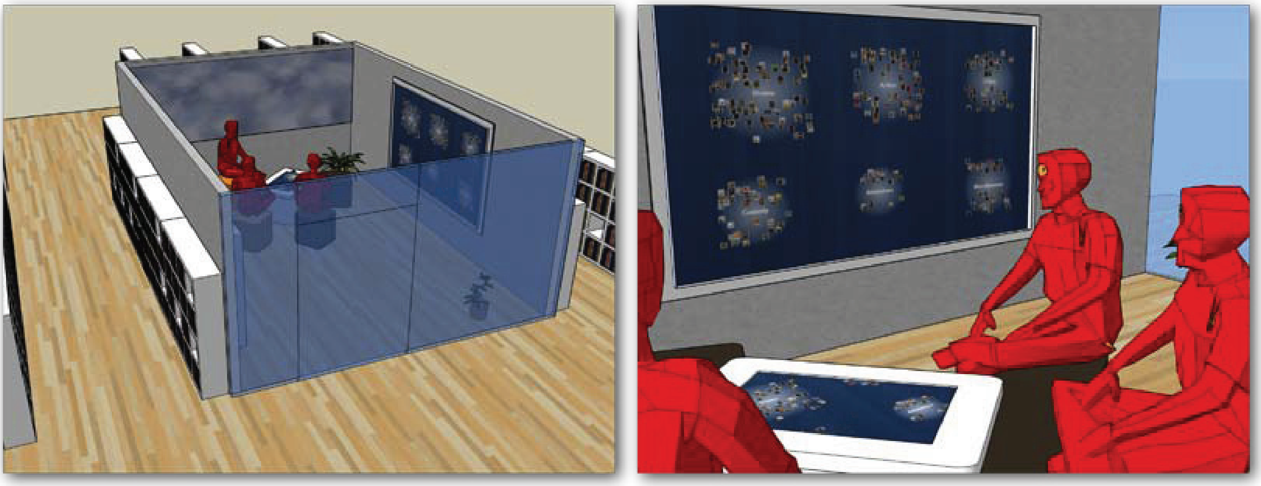

Figure 1 : Schematic illustration of our physical setting for the media library including a multi-touch tabletop display and a large high-resolution wall display.

users to interact with a system simultaneously in a natural and intuitive manner.

Related Work

The following section describes the TUI and multi-touch research concerned with co-located, collaborative query formulation that influenced our concept of the search tokens.

Ishii and Ullmer (1997) [3] explicitly suggested the application of TUIs in the context of information-management, -processing and -manipulation. The Navigational Blocks developed by Camarata et al. (2002) [5] is one example, how TUIs could be used for the interaction with databases. The system represents categories of a history application through the different faces of physical cubes. The Tangible Query Interfaces, introduced by Ullmer et al. (2003) [6], show how tangible objects can be used to represent parameters of a search query. They offer support for continuous parameters, view descriptions, Boolean 'OR' operations and dynamic binding.

Multi-touch technology promises support for co-located, collaborative information-seeking and therefore has been applied in several research projects. Cambiera, introduced by Isenberg and Fisher (2009) [8], is a system for information foraging activities on a multi-touch tabletop display. Through collaborative brushing and linking, it allows users to maintain common ground and awareness as they work, loosely coupled, on visual analytics tasks. TeamSearch from Morris et al. (2006) [7] shows co-located, collaborative search in digital photo collections by a group seated around an interactive tabletop display.

To benefit from the advantages of both, TUIs and multi-touch displays, we propose a combination of tangible on-screen controls on a multi-touch table, allowing multiple users to formulate queries and access information in a co-located setting simultaneously.

Designing Information-Seeking for Co-Located Collaboration

To present the design of our search tokens we will use a scenario where a team of students is analyzing motion picture data in a media library, equipped to support co-located, collaborative knowledge work.

The Physical Setting of the Scenario

Our design is based on a physical setting (see Figure 1) that allows to apply activities like discussing and brainstorming which normally would not be possible in the quiet environment of a library. The setting includes two main hardware devices: a multi-touch tabletop display which is used as control panel for the collaborative information-seeking and analyzing tasks and a large high-resolution display that can be used to examine detail information and as an interactive whiteboard.

The Data Set

We use the catalog data of a movie library to showcase

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our design. The information objects that are provided by our system are enriched with data from multiple web services like the IMDb, Google maps or Wikipedia. In addition, the system even provides the motion-picture data per se and enables the users to watch excerpts or the whole movie right inside of the information-seeking system.

The Presentation of the Data

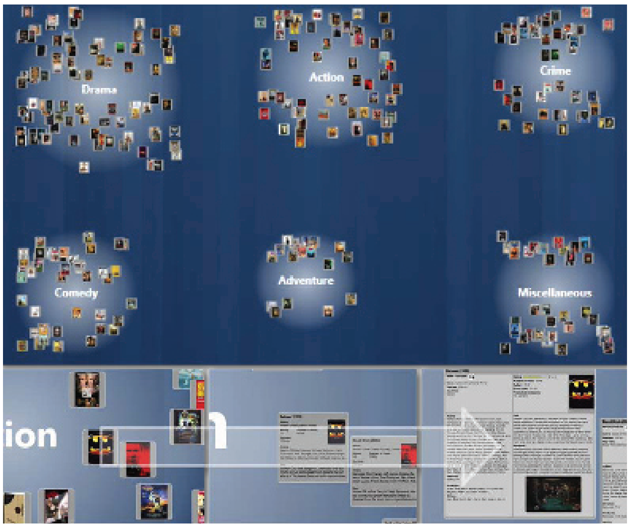

Figure 2 : The base representation of our data set: on an information landscape movie objects are clustered by their genres. Zooming onto a specific movie reveals detail information.

Although this is not the main contribution of our submission, to analyze the data set, the virtual movie objects have to be presented in a form that enables users to carry out different types of information-seeking strategies like searching, filtering, browsing and comparing. Our system presents the different data objects as virtual objects on a zoomable information landscape [9] (see Figure 2). In the base configuration of this visualization, all movie objects are placed around halos, representing different genres, as small rectangular shapes showing the poster of the movies as a visual recognition value. By zooming into the landscape, using pinching gestures on the multi-touch display, a semantic zoom of the objects is triggered [9]. The more display space a movie object covers, the more detail information and functionality becomes accessible to the users (see Figure 2).

The Search Tokens

Through this browsing-oriented exploration, users can access the data set via the genre metadata of the movies. Our search tokens (see Figure 3) are designed to perform the more sophisticated and analytical search tasks. In interplay with the tabletop display, each of these on-screen controls physically embodies a user-defined search term, enabling the users to interact collaboratively with the information system and allowing them to spatially organize multiple search terms on the table.

In our scenario a group of students is interested in movies with the comic character "Batman". As a team they intend to compare the distinct movies that were produced in different decades. They are seated around a multi-touch tabletop display, where the full content of the media library is presented. One student picks up a search token to place it on the table, where a visualization appears that is virtually connected to the physical search token (see Figure 4). Moving and turning the token will also move and turn this visualization. The visualization consists of three parts: a textbox for the filter keywords, a virtual on-screen keyboard to input the query and an indicator for the weight of the entered search term.

To initiate a search, one student enters the term: "batman". With each key press the size of all movie objects on the information landscape that match the search term in one of their metadata attributes (e.g. title, keywords or characters) increases, whereas the size of the objects that fall out of the matching subset decreases continuously (see Figure 4). This method of visualizing filters on a data set is inspired by the sensitivity-concept, introduced by Tweedy et al. (1994) [10]. Data objects that don't match a filter are not completely removed from the result set, but are brought to the background whereas the matching objects are brought to the users attention (in our case by increasing their size). After the whole search term

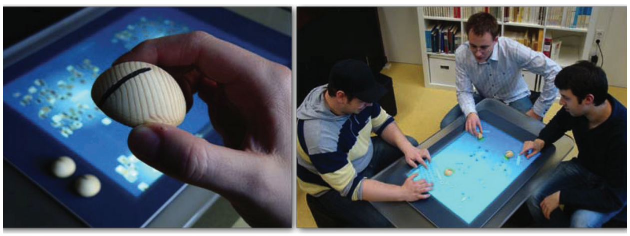

Figure 3 : Our search tokens are used by students working in a co-located, collaborative information-seeking situation.

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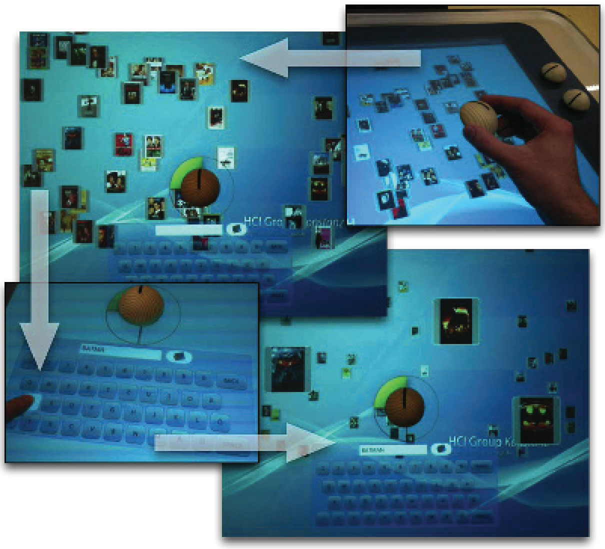

Figure 4 : A search token is used to define a filter term using the on-screen keyboard.

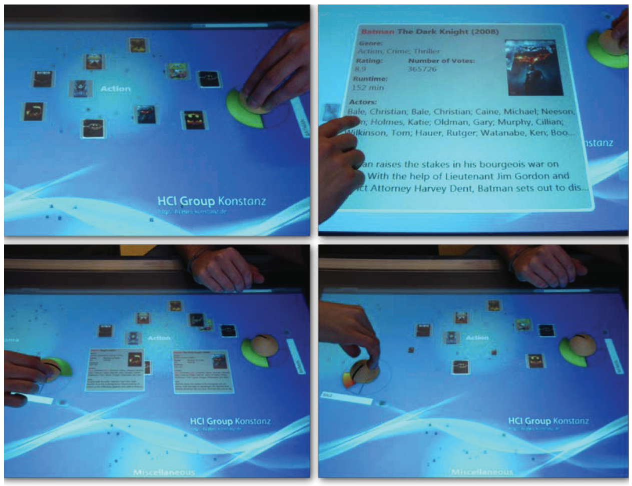

Figure 5 : Multiple search tokens are used to define complex filter queries. By turning a search token, the weight of the corresponding filter criterion is adjusted.

is entered, all movies related to "Batman" are visible to the group sitting around the display.

As next step, the students try to separate the two newest Batman-movies from the ones produced in the 90s and late 80s. Although they don't know the exact release dates of the movies, one student has an idea how to achieve this goal. He recognizes the poster of the latest Batman-movie "The Dark Knight" and zooms into its detail information by taping onto the movie object. The detail information reveals that "Christian Bale" has played the character "Batman" in this movie. The student zooms out to overview the whole data set and picks up another search token to define the search term "bale", resulting in all movies of "Christian Bale" being resized alongside all Batman-movies that already are presented larger. The two filter criterions "batman" and "bale" are combined by a Boolean 'AND', so that the two newest Batman-movies (with "Christian Bale" as "Batman") become even larger then the other Batman-movies (see Figure 5).

After a complete filter criterion is entered into the textbox, a user can hide the search token's on-screen keyboard by pressing a button in the top right of the keyboard. Now the token acts like a turning knob. Inspired by the volume knob of a radio or by a light dimmer, a search token can be turned to the right or left to increase or decrease the weight of its filter criterion. The value of the weight thereby can range from 0 to 4 (see Figure 5 and 6).

Turning the knob to the right will increase the weight of a filter criterion and thereby the size of all matching movie objects, marking them as especially important to the current search. Turning it to the left will decrease the size of the movie objects that match the filter. By turning the knob to the fare left, the weight of this filter criterion will decrease below 1, and thus shrink the matching objects to a size smaller than their default size. This way a user is able to formulate filter criterions that correspond to the Boolean 'NOT' and thus temporarily put certain objects that are not of interest to the background of the information landscape. The mathematical concept behind the weighting of the filter criterions is inspired by weighted Booleans [11]. A growing and shrinking colored indicator around the search token shows the

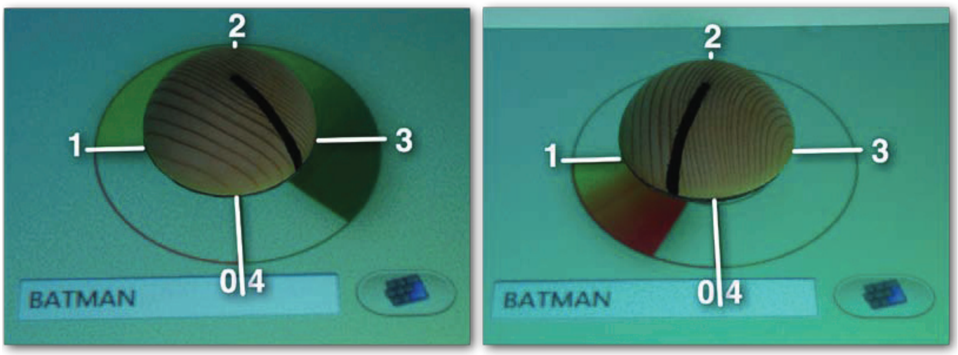

Figure 6 : Adjusting the weight of a filter in the range from 1 to 4 will let matching information objects pop out of the data set, adjusting the weight to a value between 1 and 0 will fade matching objects to the background.

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weight of a search token and the corresponding filter criterion. It glows green when the weight is larger than 1 (the filter increases a matching object's size) and red when it is smaller than 1 (the filter decreases a matching object's size). The students use this mechanism to consecutively increase and decrease the size of the new and the older Batman-movies and thus visually separate them from each other.

To further improve the access of the detail information of specific movie objects, the students transfer several objects to the high-resolution wall display. On this display they have more screen space to compare multiple movies and write annotations for further use (see Figure 7).

Figure 7. The high-resolution wall display is used to access detail information, compare different information objects and write annotations.

Outlook and Conclusion

There are a lot of topics that still have to be improved in the context of the presented information-seeking system. Scalability to larger data sets is one of the most important problems we are currently working on. To advance our vision of a collaborative information-seeking system, we will also have to find new ways to evaluate our designs and measure the quality of collaboration.

We could already observe that through their physical appearance, our search tokens suit the needs for co-located, collaborative work much better than standard user interface components like text boxes and sliders. They provide better visibility to all involved users, even when they are standing in a certain distance or around a tabletop display. Also, the simultaneous interaction of a group of users is better supported, in comparison to standard WIMP user interfaces using keyboard and mouse interaction. In addition, the natural interaction provided through real-world tangibles and multi-touch technology can be more intuitive and pleasing to the user.

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