Lee, S.S., Theng, Y.L., Goh, D.H., and Foo, S. (2004). Creative information seeking and interface design. *Proceedings of the 6th Asia-Pacific Conference on Computer-Human Interaction APCHI 2004*, (June 29 - July 2, Rotorua, New Zealand), *Lecture Notes in Computer Science 3101*, 604-609.

Creative Information Seeking and Interface Design

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Abstract. Inspired by Weisberg's argument that everyone is creative, this paper highlights a model of information seeking capturing users' creative traits by synthesizing established models in information seeking and creativity. Using Google, a pilot study was conducted to understand subjects' creative information seeking process. Claims Analysis and Interaction Framework were used to elicit design features that might have supported subjects' creative, "serendipitous" information seeking. This paper presents novel, initial work towards eliciting conceptual design features for users' creative, "serendipitous" information seeking behaviors. It concludes with a discussion on creativity and interface design for information retrieval systems.

1 Introduction

Most information retrieval (IR) systems are designed to judge precision and recall based on a match between index and query terms. This mode of operation is the 'best-match' principle [1]. However, precision and recall are limited, as they do not consider the contextual nature of human judgment [3]. Measures of precision and recall should consider that relevance is influenced by the intentions and knowledge states of users [3]. Hence, one way of addressing users' needs in IR systems may be to consider users' creative process in information seeking during interface design.

This paper presents novel, initial work towards a model for supporting users' creative, "serendipitous" information seeking behaviors. This model is inspired by Weisberg's [15] argument that everyone has creative traits. Hence, it can be logically inferred that every information seeker is creative, and the extent of a person's creativity influences his/her information seeking behavior. Creativity can be defined from many perspectives. For example, creativity may be "natural" based on one's creative traits or creativity may be "nurtured" which is due to domain knowledge and information seeking skills. Here, we are concerned with "nurtured" creativity.

The proposed model differs from traditional information seeking models [e.g., 7] as it focuses on how "creative" features in an IR environment, for example, providing collaboration features and contacts of experts [e.g. 11], may support information seeking. These features aim to support users' information seeking behavior, hence possibly addressing users' needs and increasing the quality of search results in terms of relevance and user satisfaction.

It is hoped that this model may possibly lead to new and improved ways of developing interfaces for supporting IR and users' needs.

2 Creative Information Seeking Model

To provide context for understanding findings presented later, we briefly describe the proposed six stages for creative information seeking [10]:

- Stage 1: Preparation for starting information seeking. The information seeker recognizes a knowledge gap. This triggers his/her information seeking behavior.
- Stage 2: Chaining information sources. Here, he/she is tracking related materials to understand the breadth of the topic. This helps him/her select a topic to focus.
- Stage 3: Browsing and searching. At this stage, he/she is searching and browsing information on the selected topic.
- Stage 4: Incubation for differentiating purposes. The information seeker is filtering information and establishing linkages among filtered information.
- Stage 5: Monitoring and extracting for illumination. Here, he/she is monitoring developments in the selected topic and pulling out relevant materials from sources. This helps him/her achieve a personal understanding and produce an idea
- Stage 6: Verification of information sources. Here, he/she is concerned with verifying information used to produce the idea.

3 Pilot Study

As a first step to understand the proposed model of information seeking, a pilot study was conducted using 4 subjects to carry out a preliminary investigation to ascertain the qualities of a typical interface, Google in this instance, to understand the subjects' information seeking process and to elicit "creative" design features in the interface to support it through the use of Carroll's Claims Analysis (CA) [4] and Abowd and Beales' Interaction Framework (IF) [6].

Subjects

Subject A is a 2nd year PhD student. Subjects B and C are 1st year and 2nd year Masters students respectively. Subject D is a 2nd year undergraduate student. Subjects A and C have 5-6 years of experience and Subjects B and D have 3-4 years of experience using search engines. Subjects were selected based on their experience with search engines.

Methodology

Subjects were given 30 minutes to complete an open-ended information seeking task using Google. The task was chosen based on work in [2] and had two parts. Part A required subjects to find all inventions by Leonardo Da Vinci (LDV). The purpose was to prompt their information seeking process. Part B required subjects to select an invention and describe the invention in detail, how it was created and its significance to the world. The purpose was to enable users to express their natural information seeking behavior. A form was constructed for subjects to note their answers.

As subjects performed their tasks, they were asked to think aloud. The think aloud method requires little expertise to perform but can provide useful insights into problems with an interface and how the system is actually used [6]. As subjects thought aloud, their actions were recorded by a video camera. The video data was later transcribed, including speech and descriptions of interaction between subjects and Google's search interface. These video transcripts were used to derive subjects' summaries of interactions.

After subjects completed their tasks, an interview was conducted. Questions corresponding to proposed stages in creative information seeking and questions to prompt CA [4] were asked. CA was used to elicit subjects' feedback on features that could have supported their creativity. These questions provided a better understanding of subjects' information seeking behaviors. Each interview lasted about 45 minutes and was later transcribed for analysis.

4 Findings and Analysis

CA and IF were used to analyze interview transcripts and summaries of interactions respectively to propose design features to support creative information seeking. CA is an appropriate technique as it makes use of positive and negative claims in system-user interaction to elicit design features. IF is another appropriate technique as it provides an understanding of subjects' needs through their system-user interactions.

We coded summary of interactions, proposed in [13], using the four categories in IF [6]: user action (UA), user evaluation (UE), system display (SD), and system response (SR) to elicit supportive design features. The following shows the coding for an extract of Subject C's summary of interactions. The code "(SD)" was used to elicit design features for creative information seeking.

> Subject C began his information seeking process by using the query, "Leonardo Da Vinci inventions" (UA, SD)… He used the highlighted keywords (SD, SR) and descriptions (SD, SR) to find relevant sources to access (UE).

For example, the above transcript was coded 3 times with "(SD)", suggesting the presence of the following supportive design features: providing search box and fields; ranking results; and providing highlighted keywords and descriptions in results list. Similarly, all other subjects' interactions coded with "(SD)" code were taken to suggest design features to support subjects' creative information seeking behaviors.

The interview included modified questions from CA and questions to clarify subjects' information seeking behavior. These were also used to elicit design features. We coded the interview transcripts using: positive experiences "(+)" and negative experiences "(-)". The following extract of Subject C's interview transcript demonstrates how coding was done. We made the assumption: areas in interview transcript coded with "(+)" suggested design features available in Google and areas coded with "(-)" suggested design features unavailable in Google. Using this coding, three other features were inferred from Subject C's interactions: highlighting query keywords in contents; ranking results; and providing description of each result. All interview transcripts were coded similarly to arrive at available and non-available design features for creative information seeking in Google.

> …normally I also use the Google toolbar…it allows you to highlight the words on that page (-)…the system ordered the links and put the descriptions (+) so that's how useful it was…

Next, extracts of subjects' summary of interactions and interview transcripts were organized to correspond to proposed stages in creative information seeking. Using this organization and their respective schemes of coding, an aggregated list of available and non-available design features for each proposed stage was derived. The coding "(+)" and "(SD)" elicited design features available in Google while the coding "(-)" and "(SD)" elicited design features non-available in Google. Figure 1 illustrates some proposed design features available in Google. Table 1 illustrates a list of proposed design features "non-available" in Google. In the table, proposed Stages 1-6 are depicted as S1-S6.

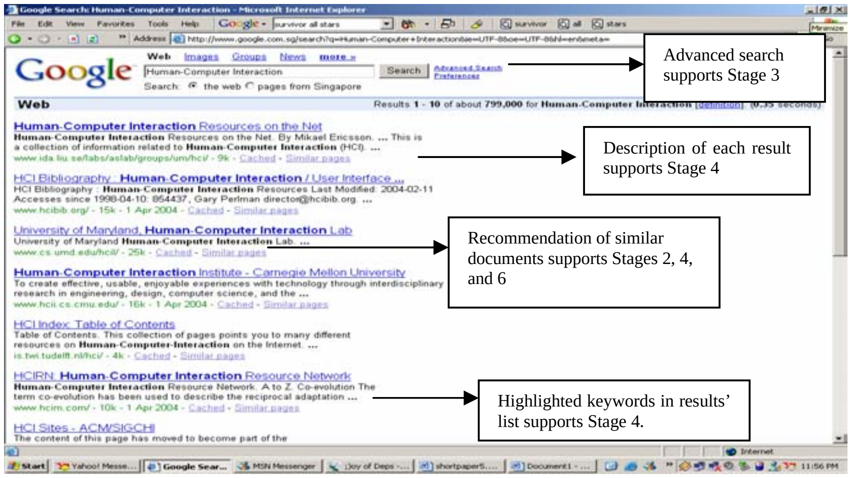

Figure 1. Some supportive design features available in Google

Table 1. Supportive design features non-available in Google

Supportive Design Features Not-Available in Google	S1	S2	S3	S4	S5	S6
Highlight keywords in contents of documents				✓	✓	
Provide a structured organization of contents				✓	✓	
Provide a variety of accessible sources		✓	✓	✓	✓	✓
Provide contacts of experts		✓	✓	✓	✓	✓
Provide collaborative features		✓	✓	✓	✓	✓
Provide links to other search engines						✓
Provide recommendations to related sources		✓	✓			✓

4 Discussion

Related works in creativity usually address users' creative traits and provide an environment for the creative process to take place [e.g., 14]. Shneiderman [11] proposes eight ways to improve software to support human creative processes. These works provide insights on the types of design features and guidelines to interface design that support creativity. However, in our work, we are concerned with developing an IR environment with "creative" features that supports users' information seeking behavior.

Modern user interfaces do not explicitly support users' creative process that requires experimentation, exploration of variations, and continual evaluation of one's progress. Instead, a linear progression through tasks is imposed, providing a poor fit for creative pursuits [12]. Our work attempts to address this limitation by developing an IR interface that closely supports users' creative information seeking behavior which may be iterative and context dependent.

In another related study, Dervin [5] proposes a sense-making approach to understand users in the design of systems. This approach may be useful in our work as it provides insights on the decisions users make while completing tasks so that features elicited are responsive to users' needs, which is lacking in CA [4] and IF [6] as these methods elicit features based on insights from system-user interaction, concerned with model of interaction for task completion. Hoorn [9] attempts to formulate a model of human capability to combine familiar objects and concepts in unusual ways, resulting in creative products. This model provides an understanding of human cognition in terms of creating creative products. This understanding may help to elicit a more diverse group of design features to support various aspects of information seeking and creativity, and may result in new and improved ways of supporting IR and users' needs.

5 Conclusion

In our earlier work, we propose a creative information seeking model [10] by synthesizing established models in information seeking [e.g. 7] and creativity [e.g. 9].

Findings suggested that Google provides features that could support creative information seeking but it does not provide an integrated environment. Hence, more can be done to possibly strengthen Google's support by incorporating other features highlighted in our pilot study.

As this work is preliminary and on-going, more needs to be done to refine and test stages in creative information seeking before they can emerge as stages and principles for designing better IR systems to support users' creative information seeking behaviors.

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