Investigating the relationships between facets of work task and selection and query-related behavior*

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Abstract

Purpose: This study aims to explore the relationships between different facets of work task and selection and query-related behavior.

Design/methodology/approach: An experiment was conducted to explore the issue. The researcher recruited 24 participants and assigned six simulated work task situations to each of them. Each experiment lasted around 2 hours and was recorded by the software tool Morae.

Findings: Time (frequency) and time (length) are more closely related to user’s selection and query-related behavior compared to the facet ‘process’ of work task. Knowledge level of work task topic, degree of work task difficulty, and subjective work task complexity are significantly correlated with selection and query-related behavior. Work task difficulty and work task complexity are different concepts. Subjective work task complexity, work task difficulty, and knowledge of work task topic are significantly correlated with user’s selection and query-related behavior.

Research limitations/implications: The limitations of this study include a small sample size, limited work task situations, and possible spurious relationships. This study has implications in informing task-based information seeking/search/retrieval research and interactive information retrieval (IIR) systems design.

Originality/values: Previous studies usually did not touch upon how different facets of work tasks affected interactive activities. Some studies examining task complexity and information behavior were concerned with how work tasks affect users’ behavior at information-seeking level, rather than at information search level. This study makes contribution to interactive information retrieval, task-based information search and retrieval, and personalization of IR.

Keywords Work tasks; Facets of work tasks; Selection behavior; Query-related behavior; Interactive information search behavior

* The research is sponsored by National Social Science Foundation of China (Grant No. 11BTQ009). The analysis is based on the author’s dissertation research conducted at Rutgers University, USA. The author would like to thank her advisor, Dr. Nicholas J. Belkin and the committee members: Dr. Tefko Saracevic, Dr. Katrina Byström, Dr. Bernard J. Jansen, and Dr. Jacek Gwizdka. Her thanks also go to the volunteers participating in this study. Without their help, the author could not complete this study.

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1 Introduction

Work task has increasingly drawn attention in information science. Ingwersen and Järvelin\cite{1} defined work tasks as motivations of information searching, including work-related or daily life tasks. In general, work tasks motivate search tasks and search tasks are associated with certain work tasks. Previous studies show that it is a critical factor in shaping user’s information search behavior\cite{2–4}. However, as Xie\cite{5} pointed out, “[t]here are more theoretical discussions and less-empirical studies on relationships between task and the IR process. While there are more works on task in general, there is less research on dimensions of task and their influences”. For this reason, it is imperative to explore how dimensions or facets of work tasks affect interactive information search behavior to help improve IIR systems design.

1.1 Related studies

Vakkari\cite{6}, Kim and Soegel\cite{7}, Kim\cite{8}, Li\cite{9}, and Li and Belkin\cite{4} have extensively reviewed previous studies on task and information seeking and search behavior. This section mainly focuses on the studies that examine the effects of facets or dimensions of task on information seeking or search behavior.

Facets of work task refer to different aspects of work tasks. Among the facets investigated, task complexity has been widely examined. The studies indicated that with the increase of the task complexity people needed more types of information, were less likely to predict the types of information they needed, but more dependent on experts to provide useful information\cite{10–13}. Bell and Ruthven\cite{14} found that the participants could differentiate the levels of complexity. Several factors, including useful information provided by the tasks, type of information, and the amount of information, affected task complexity. Gwizdka and Spence\cite{15} found that higher search effort, lower navigational speed, and lower search efficiency could be good predictors of subjectively perceived post-task difficulty. Objective task complexity affected user’s subjective judgment of task difficulty. These studies illustrate that task complexity is an important factor that shapes users’ interaction with information systems, and at the same time, it is also influenced by different factors.

In addition to task complexity, several other task facets or characteristics have been examined. Xie\cite{5} identified different dimensions of work tasks, such as nature of task, stages of task, and timeframe of task, and also the dimensions of search task, such as origination of the task, types of the task, and flexibility of the task from the data. She found that both dimensions of work tasks and search tasks affected how the participants planned a search and what to plan. To examine how work task is related to users’ interactive information search behavior, Li and Belkin\cite{4} found that objective work task complexity affected almost all aspects of interactive information search behavior investigated.
Previous studies indicate that different task dimensions have been examined in various studies. However, most previous studies examined search task characteristics rather than work task characteristics. How work task characteristics affect user’s interactive information search behavior has not been widely investigated.

1.2 Research questions

Selection behavior in this study refers to user’s selection of a search topic\cite{17}, selection of appropriate IR systems, selection of relevant and useful information objects, and so on. Querying is also a prevalent information-seeking strategy. Query-related behavior refers to user’s behavior related to identify search terms, formulate and reformulate search queries, and iteratively issue queries. The present study specifically examines how facets of work task influence these two types of interactive information search behavior. Two broad questions guide the research:

- How are work task facets related to user’s selection behavior?
- How are work task facets related to user’s query-related behavior?

This study is based on the faceted classification of task proposed by Li and Belkin\cite{16}. The facets or sub-facets examined are extracted from this classification. The faceted classification has been used as a research framework to explore the relationships between work task and search task\cite{9}, the relationships between work task in general and interactive information search behavior\cite{4}, and the relationships between work task and user’s interaction performance\cite{18}.

2 Method

An experiment was conducted to explore the research questions. The method has been described in detail in Li and Belkin\cite{4}. Here is a summary of the research design.

2.1 Variables and measures

2.1.1 Facets of work tasks investigated and measures

All work task types in this experiment were constructed based on the faceted classification of task. Two facets, namely, product and objective work task complexity, were strongly related to search task and information search behavior\cite{9}. These two facets were varied with their values to help construct work task types\cite{4}. Based on these two facets and their values, six work task types were developed and used for the experiment, including intellectual/high complexity (IH), intellectual/moderate complexity (IM), intellectual/low complexity (IL), decision/high...
complexity (DH), decision/moderate complexity (DM), and decision/low complexity (DL). Li and Belkin\(^4\) discussed the relationships between two varied facets and interactive information search behavior. The current paper focuses on exploring the relationships between the facets assessed by the participants and selection and query-related behavior. Table 1 provides the operational definitions and measures of these facets or sub-facets.

### 2.1.2 Selection and query-related behavior

Table 2 presents the measures for selection and query-related behavior. Items here refer to Web pages, full-text papers or articles (any format, such as .doc, .pdf, and .html), and bibliographic records. ‘View’ here means that the participants click a link and open the file; ‘Select’ means that the participants evaluate the file as a useful one for supporting work tasks at hand.

Therefore, the specific research questions of this study include:

- How are time(frequency) and time (length) related to selection behavior, respectively?
- How are time (frequency) and time (length) related to query-related behavior, respectively?
- How is process related to selection behavior?
- How is process related to query-related behavior?
- How are different sub-facets of user’s perception of task related to selection behavior, respectively?
- How are different sub-facets of user’s perception of task related to query-related behavior, respectively?

### 2.2 Participants

Twenty-four participants were recruited from the students in a state university in the USA, by distributing recruitment notices around the campus. The participants include 10 females and 14 males. Due to the possible influence of participant’s academic background and educational level\(^19\), this study recruited 12 participants from social science and humanities, with six undergraduate and graduate students, respectively; the other 12 participants were from science and engineering, also with six undergraduate students and six graduate students.

Twenty one participants (87.5%) assessed themselves as experienced searchers in using search engines. Twenty participants (83.3%) searched for their assignments or work-related projects weekly or daily. The average year of a participant’s experience with online information searching was 7.29 (SD=2.66) years. In general, the participants were experienced searchers.
<table>
<thead>
<tr>
<th>Facets</th>
<th>Sub-facets</th>
<th>Values</th>
<th>Operational definition</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Time (frequency)</td>
<td>Unique</td>
<td>A task conducted at the first time</td>
<td>Participants’ self-assessment based on the description of a work task.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intermittent</td>
<td>A task conducted more than one time but assessed by task doer as not a frequently conducted one</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Routine</td>
<td>A task assessed by task doer as a frequently conducted one</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time (length)</td>
<td>Short-term</td>
<td>A task which could be finished within a short time period (e.g. less than one month)</td>
<td>Participants’ self-assessment based on the description of a work task.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Long-term</td>
<td>A task which has to be finished within a long time period (e.g. more than one month)</td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td>One-time task</td>
<td></td>
<td>A task accomplished through one process without repeated procedures</td>
<td>Participants’ self-assessment based on the description of a work task.</td>
</tr>
<tr>
<td></td>
<td>Multi-time task</td>
<td></td>
<td>A task accomplished through repeatedly engaging in the same or similar process</td>
<td></td>
</tr>
<tr>
<td>User’s perception of task</td>
<td>Work task difficulty</td>
<td>User’s perception of the degree of work task difficulty</td>
<td>A 7-Likert scale from “easy (0)” to “extremely difficult (7)”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subjective task complexity</td>
<td>User’s perception of the degree of work task complexity</td>
<td>A 7-Likert scale from “simple(0)” to “extremely complex(7)”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knowledge of work task topic</td>
<td>User’s knowledge on the topic of a work task</td>
<td>A 7-Likert scale from “no knowledge(0)” to “extremely knowledgeable(7)”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knowledge of work task procedure</td>
<td>User’s knowledge on how to complete a work task</td>
<td>A 7-Likert scale from “no knowledge(0)” to “extremely knowledgeable(7)”</td>
<td></td>
</tr>
</tbody>
</table>
2.3 Experiment

The questionnaires administered to the participants during the experiment include:

- An entry questionnaire to collect the participant’s background information.
- A simulated work task situation evaluation questionnaire to evaluate the generic facet including time (frequency), time (length), and process of the work tasks, and to elicit the participants’ assessment on work task difficulty, knowledge of task topic and procedure, and subjective task complexity.
- A pre-search questionnaire to collect their knowledge about the search they would conduct.
- A post-search questionnaire to collect their evaluation about their interactive process with information systems.
- A follow-up interview was conducted after the participants finished the search for each work task.
- An exit interview was performed after they completed the search for all work task situation.

Six simulated work task situations corresponding to the six work task types were developed based on the real work tasks collected in Li\(^9\) (Appendix 1). Each participant conducted the search for the six work task situations one by one. These situations were rotated and assigned to the participants to avoid learning effects. Therefore, in total the participants searched for 144 work tasks (6 work tasks × 24 participants).

Figure 1 shows the procedure of the experiment. To collect the data, the software tool Morae logged all participants’ activities during the experiment.

2.4 Data analysis

Morae allows researchers to create marks according to the research goal. To help data analysis, a ‘start’ point and ‘end’ point for each search were first marked. Then the researcher manually extracted all necessary data from the recording. The marks and data were reexamined for ensuring accuracy. To answer the research questions, different statistical tests, such as one-way ANOVA and Pearson correlation, were performed by using the SPSS software tool to examine the research questions.
3 Results

This section first presents the relationship between facets or sub-facets and selection behavior and then between these facets or sub-facets and query-related behavior. This section only reports and discusses statistically significant results.

3.1 Facets and selection behavior

3.1.1 Time (frequency), time (length), process and the selection of web sources

Table 3 reports the results of one-way ANOVAs to test the differences between the selection of web resources across work task types categorized based on different facets. Overall the participants consulted significantly different number of search engines when searching for the unique, intermittent, and routine work tasks ($F(2, 141) = 4.49, p<0.05$). Post Hoc tests (Tukey HSD) indicated that they consulted fewer search engines for the routine work tasks than for the unique work tasks ($p<0.01$).

The participants viewed different number of web result pages for the unique, intermittent work tasks, and routine work tasks ($F(2, 141) = 7.46, p<0.01$). Post Hoc tests (Turkey HSD) indicated that the participants examined more web result pages when searching for the unique work tasks than for the routine work tasks ($p<0.01$); for the intermittent work tasks they viewed more web result pages than for the routine work tasks ($p<0.05$).
Also, there was a significant difference in the number of search engines consulted for the one-time and multi-time work tasks \((F(1,142) = 4.40, p<0.05)\). For the multi-time work tasks, the participants consulted significantly more search engines than for the one-time work tasks.

### 3.1.2 Time (frequency), time (length), process and the selection of library sources

Table 4 shows the results of one-way ANOVAs to examine the differences of selection of library resources among different work task types. A significant difference in the number of library resources consulted was detected among the

<table>
<thead>
<tr>
<th>Facets and values</th>
<th>Library sources consulted</th>
<th>Library result pages viewed</th>
<th>Library items viewed</th>
<th>Library items selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (frequency)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unique (N=22)</td>
<td>0.23 (0.43)</td>
<td>0.50 (1.01)</td>
<td>0.32 (0.89)</td>
<td>0.18 (0.395)</td>
</tr>
<tr>
<td>Intermittent (N=92)</td>
<td>0.26 (0.53)</td>
<td>0.54 (1.34)</td>
<td>0.68 (1.77)</td>
<td>0.60 (2.38)</td>
</tr>
<tr>
<td>Routine (N=30)</td>
<td>0.67 (1.03)</td>
<td>1.23 (2.27)</td>
<td>1.43 (2.43)</td>
<td>1.00 (1.66)</td>
</tr>
<tr>
<td>Time (length)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-term (N=122)</td>
<td>0.29 (0.62)</td>
<td>0.47 (1.16)</td>
<td>0.67 (1.71)</td>
<td>0.54 (2.11)</td>
</tr>
<tr>
<td>Long-term (N=22)</td>
<td>0.64 (0.85)</td>
<td>1.86 (2.64)</td>
<td>1.41 (2.46)</td>
<td>1.05 (1.73)</td>
</tr>
<tr>
<td>Process</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One-time (N=35)</td>
<td>0.26 (0.78)</td>
<td>0.26 (0.82)</td>
<td>0.57 (1.15)</td>
<td>0.20 (0.53)</td>
</tr>
<tr>
<td>Multi-time (N=109)</td>
<td>0.37 (0.63)</td>
<td>0.82 (1.72)</td>
<td>0.85 (2.03)</td>
<td>0.75 (2.33)</td>
</tr>
</tbody>
</table>
unique, intermittent, and routine work tasks \( (F (2, 141) = 4.75, p<0.05) \). Post Hoc tests (Tukey HSD) showed that the participants consulted fewer library resources for the unique work tasks and the intermittent work tasks than for the routine work tasks, both at \( p<0.05 \) level. In addition, the participants consulted significantly more library resources for the long-term work tasks than for the short-term work tasks \( (F (2, 141) = 5.21, p<0.05) \); they also viewed significantly more library result pages for the long-term work tasks than for the short-term work tasks \( (F (2, 141) = 10.71, p<0.01) \).

### 3.1.3 User’s perception of task and the selection of web resources

Table 5 presents Pearson correlation coefficients that indicate the correlation between user’s perception of work tasks and their selection of web resources. Based on the Pearson correlation coefficient, compared to subjective work task complexity, work task difficulty was more strongly correlated with the number of search engines consulted and web result pages viewed, but less strongly correlated with the number of portals visited.

<table>
<thead>
<tr>
<th>Sub-facets</th>
<th>Search engines consulted</th>
<th>Portals visited</th>
<th>Web result pages viewed</th>
<th>Web items viewed</th>
<th>Web items selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work task difficulty</td>
<td>0.33**</td>
<td>−0.19*</td>
<td>0.25*</td>
<td>0.11</td>
<td>0.07</td>
</tr>
<tr>
<td>Subjective work task complexity</td>
<td>0.24**</td>
<td>−0.24**</td>
<td>0.17*</td>
<td>0.07</td>
<td>0.10</td>
</tr>
<tr>
<td>Knowledge of work task topic</td>
<td>−0.36**</td>
<td>0.35**</td>
<td>−0.29**</td>
<td>−0.06</td>
<td>−0.08</td>
</tr>
<tr>
<td>Knowledge of work task procedure</td>
<td>−0.32**</td>
<td>0.14</td>
<td>−0.18*</td>
<td>−0.16</td>
<td>−0.14</td>
</tr>
</tbody>
</table>

Note: ** \( p<0.01 \); * \( p<0.05 \)

The participants consulted fewer search engines and viewed fewer web result pages, but explored more portals if they were more knowledgeable with the topic of a work task. They consulted fewer search engines and viewed fewer web result pages if they were more knowledgeable with the procedure to complete a work task.

### 3.1.4 User’s perception of task and the selection of library resources

Table 6 reports the results of Pearson correlation tests to identify the relationships between user’s perception of task and selection of library resources.

The participants consulted more library resources and viewed more library result pages if they assessed a work task as a more complex one. They viewed fewer library items if they were more knowledgeable with the topic of a work task.
3.2 Facets and query-related behavior

3.2.1 Time (frequency), time (length), process and query-related behavior

Table 7 reports the results of one-way ANOVAs to test the difference of query-related behavior among different work task types. The results indicated that the participants issued significantly different number of queries (indicated by the number of iteration) when they searched for the unique, intermittent, and routine work tasks ($F(2, 141) = 6.25, p<0.01$). Post Hoc tests (Tukey HSD) found that they issued significantly more search queries to the systems for the unique work tasks than for the intermittent work tasks ($p<0.05$) and routine work tasks ($p<0.01$). For the short-term and long-term work tasks, they issued more queries to the systems for the long-term work tasks than for the short-term work tasks ($F(1, 142) = 5.18, p<0.05$).

<table>
<thead>
<tr>
<th>Facets and values</th>
<th>Iteration</th>
<th>Unique queries issued</th>
<th>Mean query length</th>
<th>Unique non-stop terms used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (frequency)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unique ($N=22$)</td>
<td>5.68 (2.61)</td>
<td>4.82 (2.72)</td>
<td>3.25 (1.13)</td>
<td>7.68 (4.03)</td>
</tr>
<tr>
<td>Intermittent ($N=92$)</td>
<td>3.85 (2.72)</td>
<td>3.13 (2.13)</td>
<td>2.86 (1.37)</td>
<td>5.47 (3.81)</td>
</tr>
<tr>
<td>Routine ($N=30$)</td>
<td>3.13 (2.37)</td>
<td>2.47 (1.85)</td>
<td>2.08 (1.18)</td>
<td>3.60 (2.55)</td>
</tr>
<tr>
<td>Time (length)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-term ($N=122$)</td>
<td>3.76 (2.70)</td>
<td>3.10 (2.21)</td>
<td>2.66 (1.35)</td>
<td>5.07 (3.62)</td>
</tr>
<tr>
<td>Long-term ($N=22$)</td>
<td>5.18 (2.65)</td>
<td>4.09 (2.54)</td>
<td>3.30 (1.17)</td>
<td>7.36 (4.24)</td>
</tr>
<tr>
<td>Process</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One-time ($N=35$)</td>
<td>3.31 (2.84)</td>
<td>2.60 (2.08)</td>
<td>2.18 (1.53)</td>
<td>4.66 (4.21)</td>
</tr>
<tr>
<td>Multi-time ($N=109$)</td>
<td>4.19 (2.68)</td>
<td>3.46 (2.31)</td>
<td>2.94 (1.23)</td>
<td>5.66 (3.64)</td>
</tr>
</tbody>
</table>

The participants also issued different number of unique queries for the unique, intermittent, and routine work tasks ($F(2, 141) = 7.78, p<0.01$). Post Hoc tests
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(Tukey HSD) indicated that for the routine work tasks, the participants issued fewer unique queries than for the unique \( p<0.01 \) and intermittent work tasks \( p<0.01 \).

The analysis detected a significant difference in the mean query length across the unique, intermittent, and routine work tasks \( F(2, 141) = 6.02, p<0.01 \). Post Hoc tests (Tukey HSD) found that in general the participants issued longer queries for the unique work tasks than for the routine work tasks \( p<0.01 \). Table 7 shows that the participants issued longer query for the long-term work tasks than for the short-term work tasks \( F(1, 142) = 4.41, p<0.05 \); they also issued longer query for the multi-time work tasks than for the one-time work tasks \( F(1, 142) = 8.86, p<0.01 \).

It was also found that the participants used different number of unique non-stop query terms for the unique, intermittent, and routine work tasks \( F(2, 141) = 8.08, p<0.01 \). Post Hoc tests (Tukey HSD) indicated that for the unique work tasks, the participants used more unique non-stop query terms than for the intermittent \( p<0.05 \) and routine work tasks \( p<0.01 \). The analysis also found that the participants issued significantly more unique non-stop query terms for the long-term work tasks than for the short-term tasks \( F(1, 142) = 7.11, p<0.01 \).

### 3.2.2 User’s perception of work task and query-related behavior

Table 8 shows Pearson correlation coefficients that indicate the correlation between different user’s perception of task and query-related behavior. Both work task difficulty and subjective work task complexity were positively correlated with the number of iteration, unique queries issued, unique non-stop query terms, and the mean query length. The participants issued more queries and more unique queries, used more unique non-stop query terms, and issued longer queries if they were less knowledgeable on a work task topic. They issued longer queries if they were less knowledgeable on work task procedure.

<table>
<thead>
<tr>
<th>Sub-facets</th>
<th>Iteration</th>
<th>Unique queries issued</th>
<th>Mean query length</th>
<th>Unique non-stop terms used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work task difficulty</td>
<td>0.34**</td>
<td>0.33**</td>
<td>0.37**</td>
<td>0.34**</td>
</tr>
<tr>
<td>Subjective work task complexity</td>
<td>0.30**</td>
<td>0.28**</td>
<td>0.35**</td>
<td>0.31**</td>
</tr>
<tr>
<td>Knowledge of work task topic</td>
<td>–0.37**</td>
<td>–0.33**</td>
<td>–0.28**</td>
<td>–0.27**</td>
</tr>
<tr>
<td>Knowledge of work task procedure</td>
<td>–0.14</td>
<td>–0.13</td>
<td>–0.25**</td>
<td>–0.14</td>
</tr>
</tbody>
</table>

Note: **\( p<0.01 \)

### 4 Discussion

Different from previous studies that are concerned with task and information-seeking or search behavior\(^2-4,15,16\), the present study examines how different facets of work
tasks are related to selection and query-related behavior. This section further elaborates the research findings.

4.1 Facets and selection and query-related behavior

Make a step forward, this study found that time (frequency), the same construct as nature of task defined in Xie[5], significantly affect the selection of web page and IR systems. The results indicate that time (frequency) affects user’s information source selection and usage, as Alwis et al.[23] found. For the routine work tasks the participants consulted significantly more library resources than for the unique and intermittent work tasks. This finding adds more points to Niu et al.[24]. They found that for academic scientist’s research activities, electronic resources subscribed by the library play more important role than web resources. Accordingly, it is very important to maintain a high quality subscribed electronic resource for a university library.

Because users need to issue significantly more queries and longer queries for unique work tasks and long-term work tasks, they need to exert more interaction efforts to explore IR systems, and thus have heavier cognitive load when performing such work tasks. Therefore, it is necessary to provide more support for users who have such work tasks at hand when designing an IIR system.

A series of Byström and her associates’ studies[10,13] found that task complexity shapes user’s information-seeking behavior in different ways. This study supports this viewpoint. Moreover, the study suggests that task difficulty and task complexity are two different variables due to their different effects on user’s interaction with information systems, though these two facets are significantly correlated with each other (r (144) = 0.84, p<0.01). This finding supports Li[9] and Bell and Ruthven[14]. Thus, it is necessary to conceptualize and measure them in a distinctive way. For example, task difficulty could be defined as to what extent a user has to overcome cognitive or physical barriers for completing a task, while task complexity is to what extent a user has to handle multiple paths to a task, multiple desired outcomes, complicated relation of paths and outcomes, and so on[25]. However, this still calls for further examination on how to conceptualize and measure them in a meaningful way. Li et al.[26] made effort to explore a model that could more precisely measure task complexity in information seeking.

This study indicates that a more complex or difficult work task leads to more search activities in search engines, but fewer browsing activities in portals. This suggests that user’s perception of work task complexity and difficulty may affect the selection of querying or browsing strategies. This study adds more points to the previous finding that users prefer querying for specific search tasks, but browsing for general search tasks[27]. Further, this study suggests that not only different types
of search task but also work task complexity and difficulty could affect user’s preference of querying or browsing strategy.

Knowledge of task topic or topic familiarity has been recognized in some studies as an influential factor in shaping user’s information searching behavior, including search strategies and the type of information needed[28–30]. Kelly and Cool[31] found that topic familiarity significantly and positively affected user’s search efficacy (measured by the ratio of saved documents to total viewed documents). Wen et al.[32] also found that for unfamiliar tasks users need to consult more formal resources and search engines. The present study supports the previous findings. It detects a significant but negative relationship between knowledge level of work task topic and the number of search engines used.

This study found that different sub-facets of user’s perception of work task are correlated with portals visited. Accordingly, user’s perception of work tasks is more powerful in terms of leading users to browse the Web. This also suggests that though in general a work task influences interactive information search behavior, in terms of different facets of a work task some facets play more important role than others. This provides empirical evidence to support Xie[5] and Li and Belkin[4]. That is, it is necessary to examine the effect of work task on interactive information search behavior in terms of different aspects or dimensions of work task.

The study indicates that user’s perception of work tasks is more important in shaping user’s interactive behavior than time and process. Moreover, based on the highest correlation coefficient, knowledge of work task topic is more strongly correlated with selection of web resources; both work task difficulty and knowledge of work task topic are more strongly correlated with query-related behavior; subjective task complexity is more strongly correlated with selection of the library resources compared to other sub-facets of user’s perception of work task. The results support that different sub-facets play different roles in shaping user’s interaction with information systems[4].

This study extends the findings in Li and Belkin[4] and indicates that users indeed select search engines, portals, library resources based on their work tasks at hand. More specifically, user’s knowledge level of work task topic play the most important role in the selection of search engines and portals, while subjective work task complexity, task (frequency), and time (length) are factors that significantly affect user’s selection of library resources. In addition, in terms of work task types, decision/solution work tasks more likely motivates user’s browsing activities[4], while with regard to user’s perception of work tasks, the current study indicates that the three variables, such as knowledge of work task topic, subjective work task complexity, and work task difficulty, influence the selection of querying or browsing strategies, but to different degrees.
Compared to selection behavior, query-related behavior is more sensitive to various facets of work tasks. User’s perception of work task complexity, difficulty, and knowledge level of work task topic is significantly related to the selection of querying or browsing for locating useful information. However, work tasks and their facets only shape some aspects of user’s selection and query-related behavior, rather than all aspects.

4.2 Limitations and implications

Due to the constraints of the research design, this study could not examine all facets identified in Li and Belkin[16]. The small sample size (24 participants) may bias the results. Also, due to the limitation of an experiment, for each work task type, only one simulated work task situation was developed. As well, for the multi-process and long-term work tasks, the study could not catch up the evolving process when a user conducts sequential searches for such tasks, and thus could not give a holistic picture of searching for such work tasks. Because the study tested quite a number of relationships among the variables, it is possible that there are some spurious but statistical significant results surfaced.

However, the implications of this study are obvious. Previous studies[21,33] usually do not touch upon how different facets of work tasks affect interactive activities. Some studies examining task complexity and information behavior are concerned with how work tasks affect user’s behavior at information-seeking level, rather than at information search level[12-13]. Based on the previous studies, the present study adds more knowledge on work tasks and user’s interaction with IR systems. It focuses on different facets and attributes of work tasks and explores how they are related to selection and query-related behavior via a quantitative approach. The findings help people understand the effect of work task facets on user’s interaction with IR systems better and make contributions to task-based information seeking and retrieval areas.

According to Belkin[34], personalization of IR is a multi-dimensional concept and the task should be considered as one of important dimensions. However, how to personalize IR based on tasks? The present study suggests that it may be a good way to select some influential facets of work tasks as a starting point. Some studies support this view[35,36]. Due to the significant and strong relationships between these facets and user’s selection and query-related behavior, it is possible to know user’s work task characteristics based on observing and calculating user’s interactive behavior, and accordingly design more intelligent and personalized IIR systems. This implicit approach is the most usual way to personalize information retrieval[36].
Therefore, the present study not only contributes to understanding the effect of work task facets on user’s interaction with information systems, but also informs the IIR systems design, especially in terms of personalization of IR to user’s work tasks at hand.

5 Conclusions

This study investigates the relationships between the facets of work task and user’s selection and query-related behavior. The results indicate that time (frequency) and time (length) are influential facets in shaping user’s selection and query-related behavior. The study found that the sub-facets of user’s perception of tasks are significantly related to different aspects of user’s interactive information search behavior. Among these sub-facets, user’s self-assessed knowledge level of work task topic, degree of work task difficulty, and subjective work task complexity play important roles. They affect selection and query-related behavior to different degrees. Knowledge of work task topic is the only sub-facet of user’s perception of task that is significantly correlated with the number of library items viewed. The results also show that work task difficulty and work task complexity are different concepts, though they are correlated with each other. Subjective work task complexity is significantly correlated with the number of library resources consulted and library result pages viewed, while work task difficulty is not. Therefore, their effects on information search behavior should be investigated separately. The study suggests how to define these two constructs distinctively. The results also indicate that subjective work task complexity, work task difficulty, and knowledge of work task topic are significantly related to user’s selection of querying or browsing for locating useful information. This study has implications in task-based information seeking and search research and IIR systems design.

Future studies need to recruit more participants and develop more work task situations for each work task type. The studies will use more research methods, for example, gathering user’s interaction data in a real context, to improve the reliability and validity of the research. Overall, future studies will continue to make contribution to interactive information systems (IIR) design and task-based information seeking and retrieval area.

References


Investigating the relationships between facets of work task and selection and query-related behavior

Yuelin LI

Research Paper


Appendix I: Work task types and simulated work task situations

<table>
<thead>
<tr>
<th>Type</th>
<th>Value involved</th>
<th>Scenario</th>
<th>Instructions</th>
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<tbody>
<tr>
<td>1:IH</td>
<td>Intellectual high objective task complexity</td>
<td>Work task: Imagine you are a graduate student working on a research project titled “Global warming and human life”. You would like to investigate how global warming would affect people’s everyday life. For this project, you need to review previous studies, design your research, collect data, analyze the data, and write a research report. You are now just starting on this project.</td>
<td>Instructions: You need to search for any information that could help you understand the general research topic, and the different ways in which the project would be designed.</td>
</tr>
<tr>
<td>2:IM</td>
<td>Intellectual moderate objective task complexity</td>
<td>Work task: Imagine you are taking a course and your final project is to write a research paper about the “history of jazz.” You should give a comprehensive introduction about the history of jazz in this paper. You need to read the relevant documents, write the paper, and present it to the class.</td>
<td>Instructions: You need to search for any information that could help you to start your work task.</td>
</tr>
<tr>
<td>3:IL</td>
<td>Intellectual low objective task complexity</td>
<td>Work task: You are taking a course about preparing for job hunting. One of your assignments is to write a resume. You decide to write a resume which is appropriate and strong for applying for jobs in journalism, but you have no ideas what should be included in this type of resume. You should read the relevant materials and begin writing your resume.</td>
<td>Instructions: You need to search for any information that could help you to complete your work task.</td>
</tr>
<tr>
<td>4:DH</td>
<td>Decision/solution high objective task complexity</td>
<td>Work task: Imagine you are planning to apply for an MBA program in the United States. You need to decide the appropriate programs to apply for. You also need to consider the location of these programs, compare their tuition, investigate their academic reputation, consider your GMAT score (imagine you got 700 points, a good score), then make the decision and prepare your application package (including writing your personal statement, cover letter, and your request for references, and so on).</td>
<td>Instructions: You need to search for any information that could help you to complete your work task.</td>
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Investigating the relationships between facets of work task and selection and query-related behavior

<table>
<thead>
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<th>Type</th>
<th>Value involved</th>
<th>Scenario</th>
<th>Instructions</th>
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<tr>
<td>5:DM</td>
<td>Decision/solution moderate objective task complexity</td>
<td>Work task: You are doing a take-home exam and need to answer several questions related to a cognitive bias “endowment effect:” 1) What is “endowment effect?” 2) List at least three experiments conducted by researchers regarding this bias; and, 3) List at least one researcher who disagrees with this bias and his views. You need obtain and read the related materials, and write down the answers.</td>
<td>Instructions: You need to search for any information that could help you to complete your work task.</td>
</tr>
<tr>
<td>6:DL</td>
<td>Decision/solution low objective task complexity</td>
<td>Work task: You need to take at least three courses next semester and your advisor has asked you to check the classes offered next semester in your program before you make this decision.</td>
<td>Instructions: You need to search for any information that could help you to complete your work task.</td>
</tr>
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