

# Towards an Understanding of Transactional Tasks

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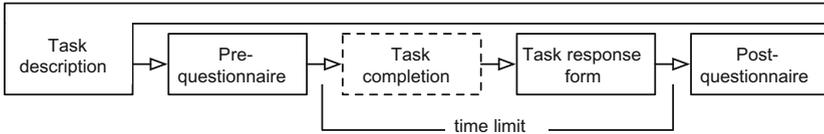
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**Abstract.** Understanding search behavior in the context of the larger work task is of key importance in order to build search systems that can assist users in achieving work task completion. This study explores a particular type of task, transactional, that has not received due attention in the literature so far. A total of 38 users were observed in a laboratory experiment where they completed tasks at different complexity and difficulty levels. We perform both qualitative and quantitative analysis of users' perception of task difficulty and search engine support. Further, we identify two main search strategies that people employ when completing transactional tasks.

## 1 Introduction

Search engines are one of the main instruments people use when seeking information to accomplish some task, e.g., planning a travel or a writing a report for a school assignment. For a long time, information retrieval (IR) research has focused on the identification of relevant items [12]. However, the work task that motivated the use of a search engine in the first place generally involves more than just search; it requires a particular outcome (e.g., a report, an email response, or a decision). For example, it has been shown for decision-making tasks that people spend two-thirds of their time on task completion even after a sufficient set of relevant documents has been found [12]. Understanding how search systems perform on the work task level has gained increasing attention over the past years. There exists a large body of work on examining search tasks through query and click logs, see, e.g., [1, 3, 8, 11]. Some particular problems have been investigated extensively, e.g., identifying cross-session search tasks within a user's search activity [1, 8, 11] and providing task-aware query recommendations [4]. Importantly, search logs reveal only a portion of the actual user activity that is spent on completing a given work task. The process itself, as well as various other tools that may be involved, cannot be understood unless the user's entire task-related activity is observed; this is exactly what we are aiming to study in this work.

Exploring the relationship between work task and interactive search behavior is a topic that lies in the intersection of information seeking and interactive IR research [7, 10]. A broad range of tasks have been analyzed in the past,



**Fig. 1.** Experimental workflow. The dashed box represents the step where participants were working on the task. The task description was visible throughout all stages.

including factual [7,9], navigational [5], interpretive [7], exploratory [7,9], and decision-making [10,12]. One task type that has not received due attention in the literature is *transactional tasks*, which we define as follows: tasks motivated by the intent of conducting a specific transaction, typically involving a monetary consideration or exchange. Common examples include purchasing an item, making travel arrangements, or planning an event.

The completion of a transactional task involves (i) the process of searching for information, (ii) decision making (which might give rise to additional information needs, i.e., going back to (i)), and (iii) the actual completion of the transaction. One distinctive element of transactional tasks, as opposed to some of the other task types (e.g., exploratory or informational) is that there is a clear and definite point that marks its accomplishment: typically, when the payment (or booking) is made.

We study, in a laboratory setting, how people go about completing such tasks. The goals of this research are threefold. First, we aim to gain an understanding of the perceived difficulty of such tasks. Second, we aim to determine what level of support users expect from the web search engine and what is the functionality that they lack. Third, we aim to identify general behavioral patterns (in particular, strategies w.r.t. search engine usage) that people exhibit when completing transactional tasks.

## 2 Experimental Setup

To understand how people search for information when working on transactional tasks, we set up a laboratory experiment.

### 2.1 Setup and Design

For the purpose of this experiment a specific website was designed. Both the presentation of instructions and the delivery of results was done through this website. Each participant was given two tasks to complete, sequentially, one from each complexity level. The difficulty (familiarity) of the task was chosen randomly. For each task a certain time limit was given (10 or 20 mins). Participants were instructed to submit the task outcomes via a web form; the form was to be submitted even if they did not manage to complete the task entirely. We shall refer to these submissions as the *task response forms*. Additionally, before

and after each task, participants were asked to fill in *pre- and post-questionnaires*, which included the following questions: (i) difficulty of the task (on a scale from 1 to 10); (ii) search engine support (on a scale from 1 to 10); (iii) if they will be able (pre) or were able (post) to complete the task (yes/no); (iv) what is it that they find difficult about the task (free text); (v) reasons for being/not being able to complete the task (free text); (vi) recommendations on how to improve the search experience/service (free text, post-questionnaire only).

All participants were from the same age group, computer science bachelor students, with both genders represented. Each person was provided with a personal computer and a screen capture program. Before the experiment, they were given instructions on how to use screen recording software. The video recordings were collected after the experiment. Participants were not given any instructions or hints on how to go about the tasks and were free to use any (online/offline) tool of their choosing. All responses and video recordings were collected anonymously. Figure 1 illustrates the experimental workflow.

## 2.2 Tasks

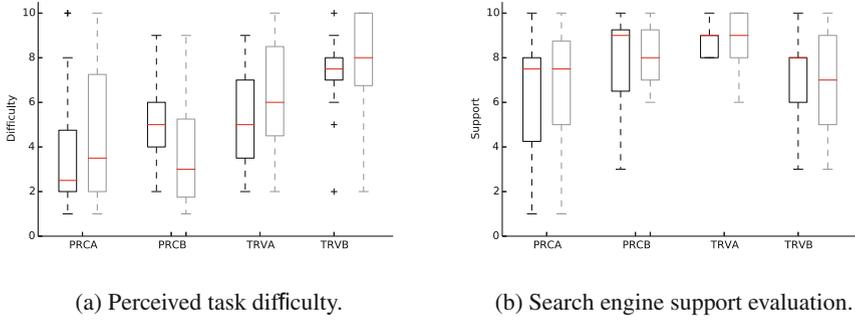
We study two transactional tasks that are frequently performed on the web [6]: purchasing a product (PRC) and travel planning (TRV). The two tasks differ in their complexity: finding a single item to purchase is a relatively simple task, while travel planning involves a series of interdependent (transactional) subtasks. Each task is studied on two difficulty levels: in familiar (A) and unfamiliar (B) task domains. Since all participants are from the same population (in terms of age, location, and profession), familiarity is established based on their assumed background. The tasks are considered complete when the target items are identified (i.e., no actual purchases were made).

*Purchasing a product.* The task is to find a product to be purchased that matches a set of requirements. Participants were given a max. of 10 min to complete the task. Then, the webpage of the selected product was to be submitted; they were also given a free text input field to provide any additional comments they might have. The two difficulty levels are as follows:

- **(PRCA)** Find a laptop with given a set of min. requirements (processor, memory, etc.), with constraints on price and delivery date.
- **(PRCB)** Find a motor boat with a given min. specification (length, facilities, etc.), with constraints on price and delivery date.

Since our participants are computer science students, their level of familiarity with laptop configurations is high. On the other hand, most of them probably have little awareness of boat specifications.

*Travel planning.* The task is to plan a travel, with time and budget constraints. Participants were given (max) 20 min to find (i) means of transportation, (ii) accommodation, (iii) place(s) to eat at, (iv) places to visit, and (v) a budget



**Fig. 2.** For each task, pre-survey results are on the left, in black, and post-survey results are on the right, in grey. Whiskers correspond to 25 and 75 percentiles.

breakdown for each category of expense. A free text field was given for each of (i)–(v) on the response form, along with an optional comments field. The two flavors of the task are as follows:

- **(TRVA)** Plan a conference travel to a neighboring country, given the travel dates and budget. Find flight, accommodation, a place to eat at, and five places to visit.
- **(TRVB)** Plan a holiday trip to a country, on another continent, that involves visiting two different cities. Find means of transportation, accommodation (for both cities), places to eat at (one per city), and five places to visit.

It is likely that participants have knowledge about the neighboring country, and have even been there already for a visit, rather than about a country on another continent. The budget constraints were set in both cases such that fitting within them is non-trivial.

### 3 Results and Analysis

We collected a total of 60 complete submissions (including pre- and post-questionnaires as well as the task response forms), from 38 users. These are roughly evenly distributed among the four tasks: 14 for PRCA, 15 for PRCB, 15 for TRVA, and 16 for TRVB.

#### 3.1 Perceived Difficulty

Users were asked to rate the perceived difficulty of the assigned task and to indicate whether they will be able/were able to complete it. Figure 2a shows the level of difficulty for each task, as indicated before (left, in black) and after (right, in grey) completing the task. We observe that the travel planning tasks are considered more difficult than the purchase tasks, which is expected. Also not surprisingly, the unfamiliar flavors of the tasks are always regarded more

difficult than the familiar ones. With the exception of PRCB, users tend to underestimate task difficulty.

To gain a better understanding of what makes these tasks difficult, we analyzed the comments left behind in the free text fields. We developed a coding scheme based on a first pass over the responses. Once the various aspects were identified, all responses were labeled using this coding scheme in a second pass over the data. The annotations were done by two authors of the paper. Due to space constraints we summarize our main findings without presenting quantitative results. For the purchase task, the low pre-task difficulty can be attributed to users' confidence in search tools and domain knowledge; the requirements are clear, thus the task is generally considered easy. The most difficult aspects identified after completion include fitting within (all the) requirements and finding specific information. As for travel planning, the prime reason that makes the task appear easy is the availability of search tools and services, coupled with prior experience. On the other hand, finding specific entities, preparing and meeting the budget, and lack of time make the task hard. In the end, these are indeed the top 3 reasons that made the task difficult. However, the lack of time turned out to be a more severe problem than the budget. In summary, we find that users can identify the most difficult aspects of these tasks, even though they tend to underestimate the degree of those difficulties.

### 3.2 Search Engine Support

How well search engines support the completion of these particular tasks? What kind of support do users lack? Fig. 2b shows the *expected* (pre-task) and *actual* (post-task) level of search engine support. It is clear from the figure that for the familiar tasks (PRCA and TRVA) users have realistic expectations towards search engine support; their initial evaluations do not change after completing the task. For unfamiliar tasks (PRCB and TRVB), on the other hand, people tend to expect more than what they can actually get from search engines; support levels drop by 1 point on average.

We find that for PRCA the support level remains the same, while for PRCB, the initially very high values drop. The most common feedback response was that users would prefer to have more categories for filtering results (e.g., searching for boats that have kitchen). For both purchase tasks, some users commented in the post-survey that they would like to have the possibility of putting in specific requirements in the (Google) search box (requirements that specialized sites provide, e.g., as filtering options).

The familiar travel task (TRVA) did not yield any surprises. One particular information need that lacked proper support, based on the comments, was finding "cheap restaurants." Users apparently were prepared to have only limited support for that the unfamiliar travel task (TRVB), but the actual support was even lower than what they expected. For both travel tasks, users expressed a wish for "a tool that plans the trip."

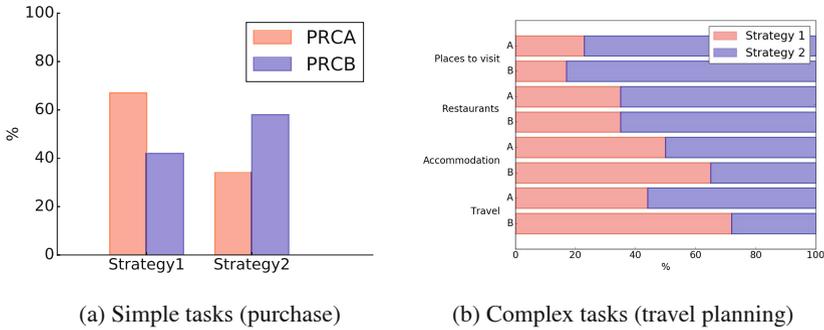


Fig. 3. Strategy usage for simple and complex tasks.

### 3.3 Task Completion Patterns

Are there general behavioral patterns or search strategies that we can observe? To answer this question, we manually annotated the recorded screen captures with the actions users performed. We can observe two general strategies for simple (purchase) tasks:

- **Strategy 1** Users use the search engine merely to find a known site. Then, they navigate there and use the site’s internal search and filter functionality to find the item that is subject of the transaction.
- **Strategy 2** The search engine is used for locating the specific items of interest directly. Further details are then obtained from the website of the item (and that is also where they conclude the transaction).

From Fig. 3a it is clear that for the familiar flavor of the purchase task (PRCA), more users tend to follow Strategy 1, while for the unfamiliar version Strategy 2 is preferred. Interestingly, for complex tasks, we find that users first break them down to a sequence of simple tasks, and then employ either Strategy 1 or 2 for each sub-task. Figure 3b shows how the two main strategies are used for the various sub-tasks of travel planning.

## 4 Conclusions

In this paper we have studied how users behave when completing transactional tasks, in a laboratory experiment, and have reported on our initial findings. Transactional queries are generally considered very hard as “most external factors important for users (e.g., price of goods, speed of service, quality of pictures, etc.) are usually unavailable to generic search engines” [2]. Indeed, we have observed that users generally perceive transactional tasks as difficult. We have also found that users have a tendency of overestimating the level of support they can get from the search engine when facing unfamiliar tasks. Based on users’ feedback, we could identify aspects where search engines could improve current

services: finding specific entities (e.g., products, hotels, restaurants), properties of entities (e.g., shipping date, prices, menu), and offering additional filtering and sorting options on the SERP (similar to what specific verticals provide).

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