Information Seeking Tasks: Why Do Searchers Feel Them Difficult?

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ABSTRACT
In this paper, we propose a framework that highlights the reasons for information task difficulty and evaluate and refine it using a case study results. Implications of our framework on search system design are suggested.

Keywords
Task difficulty categories, task features, user knowledge, system interface, document features

INTRODUCTION
Information search tasks have different difficult levels to users. Difficult tasks can lead to users not finding desired information and often generate frustration. Search systems want to help people locate information effectively, efficiently, and enjoyably, and reducing task difficulty is an important effort to these ends. Researchers have studied query performance/difficulty from the language model perspective (e.g., Carmel et al., 2006; Cronen-Townsend et al., 2002), but it is necessary to understand difficulty at the task level from the user's perspective: why users feel tasks are difficult, and what makes the tasks difficult, etc.

Task difficulty has been attracting researchers' attention, who have studied users' behavioral differences in difficult vs. easy tasks (e.g., Aula, Khan, & Guan, 2010; Gwizdka, 2008; Liu et al., 2010) and predicting task difficulty from user behaviors and other variables such as background, etc. (e.g., Gwizdka 2008; Liu et al., 2010). However, little effort has been spent using qualitative approaches on exploring why users feel difficult and what leads to task difficulty.

This paper outlines our ideas about the various aspects of reasons that may make a task difficult, and what search systems can do to help people with difficult tasks. We first propose a framework, and then evaluate it using a case study. Implications on system design are discussed and future research directions are introduced.

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A FRAMEWORK
Users' interacting with information systems involves several components: user, task, documents, and system. Each component may contribute to a task being difficult to the searcher.

1. The user

The users may have some attributes that can make a task appear difficult to them. For example, they may have low knowledge levels with the task topic, little experience with the search system, problems in understanding the task requirements, and so on.

2. The task

It is obvious that the task itself has some attributes that may make it difficult to the users. For example, the task may be beyond the user's understanding (it has a mutual relationship with the users' low level of topic knowledge), or it may be complicated and requires multiple steps to be accomplished, etc.

3. The documents

Another aspect that may make the user feel task difficulty is the documents that are retrieved. They may be beyond the user's comprehension (again, it has a mutual relationship with the user's low level of topic knowledge), they may be too long for the user to read and comprehend in a limited amount of time, or they may not cover exactly the information that the user needs, to name a few possibilities.

4. The system

The system is certainly an important aspect that may make the user feel his/her task difficulty. Ease of use, etc., has been much researched in usability evaluation studies.

A CASE STUDY

The Experiment

A user experiment was conducted in an on-campus computer lab to explore searchers' behaviors in information tasks with different difficulty levels. A total of 8 undergraduate students (3 male and 5 female) participated in the study, each working on 4 assigned information tasks (details below) in an assigned task order that was designed following a Latin-square rotation. A training task was administered before the 4 tasks to familiarize the users with the search system and task format. Each participant was asked to freely search online and save the documents that they thought would help them solve the assigned tasks. Users' interaction with computers was logged. Each participant was compensated $15 upon completion of the experiment. They were also told in the beginning of the experiment that the top 20% participants who saved the best sets of documents for the tasks would get an additional $10.

The four tasks were designed according to a faceted classification scheme (Li & Belkin, 2008), which classify task features on different dimension. We controlled two facets that were found to have significant influence on task difficulty in previous studies: product (intellectual vs. factual) and task goal (quality) (specific vs. amorphous). The four tasks were: 1) searching for graduate school admission requirements; 2) gathering information to make a Wikipedia entry for someone; 3) finding at least one hat-trick soccer player in Italian series A in 2010-2011; and 4) collecting articles about Alfred Whitehead's "simple location" concept.

Task ID	Task topic	Product	Goal (quality)
T1	Graduate School application	Intellectual	Specific
T2	Wikipedia entry	Factual	Amorphous
T3	Soccer	Factual	Specific
T4	Alfred Whitehead	Intellectual	Amorphous

Table 1. The four tasks

Questionnaires were used before and after each task to elicit users' self-assessed knowledge levels with the task topic, and their perceived task difficulty levels, etc. The pre-task questionnaire asked users to rate their expected task difficulty levels, on a 7-point scale (1=not difficult, 7=extremely difficult), and answer two questions: 1) why they gave those ratings, and 2) what made them think the task would be difficult. The post-task questionnaire also asked users to rate their reflected task difficulty levels and the two questions why they gave those ratings and what made them think the task was difficult.

Results

Users' task difficulty ratings and their responses to the questions why and what makes/made them think the task difficult in both the pre- and the post-task questionnaires were analyzed. Among a total of 32 user-task sessions (8 users by 4 tasks), there were 4 missing responses in the pre-task questionnaires. We examined users' responses to both questions about why and what makes them feel the task difficult, and categorized their responses into different categories.

Results show that all responded the tasks were difficult except for 6 pre-task and 4 post-task responses to the Soccer task being not difficult. The following listed the categories of reasons for pre- and post-task difficulty perceptions respectively, with the number of occasions in each category (N). They are then summarized and compared.

Reasons for pre-task difficulty perception

- Complexity (N=4)

For example, for T1: the graduate school application, one user commented *"There are several components of this task that need to be addressed--this makes it more complicated*."

- Too much information (N=2)

For example, for T1, one user responded: "*Narrowing down a wide range of opportunities to just 2 schools in 15 mins*."

- Time limitation (N=1) (see the above example)
- Specific requirements (N=4)

For example, for T1, one user responded "*It might be difficult to find a grad school for my particular major, art therapy*."

Another responded: *"Because I'm looking for something specific, and something that isn't really popular to the rest of the world*."

Another instance, for T3: Soccer hat-trick, one commented "*Because the information needed is so specific that it will be much more difficult to find*."

- Resource credibility (N=4)

For example, for T3: Alfred Whitehead, one responded "*I have to find 5 sufficient articles and I'm sure some of them will be unreliable*."

- Not enough information (N=5)

For example, for T2, Wikipedia entry, one responded: "*It may be very difficult to gather information on someone if they are not famous enough to have a wikipedia page*."

- Understanding about task requirements (N=1)

For example, for T4, Alfred Whitehead, one responded "*Don't know exactly what I am look up*."

- Low level of knowledge (N=2)

For example, for T4, one responded: "*I have no knowledge of the subject so I won't know exactly what I'm looking for.*"

- Low level of experience (N=1)

For example, for T4, one responded "*Never did such a search before - or creating a wikipedia entry for a specific person, especially someone who is not on wiki already.*"

- System performance (N=1)

For example, for T4, one responded "*I will most likely be using the school database so it may take a while.*"

Reasons for post-task difficulty perception

- Time limitation (N=2)

For example, for T1, one responded "*It was not really difficult except for the time taken.*"

- Specific requirements (N=13)

For example, for T1, one responded "*I just had trouble finding one page that would be most useful to one looking into graduate school opportunities*."

- Complexity (N=2)

For example, for T1, one responded "*there are so many schools offering my major. Narrowing it down was a process.*"

- Low level of topic knowledge (N=9)

For example, for T3, one responded "*It was difficult in that I was not familiar with certain cites it was on, it was easier over time after learning more information about the topic*."

- Too much information to narrow down (N=2)

For example, for T4, one responded "*There were some good sources but I felt there was just too much information present to explain a single term*."

- Confirmation (N=2)

For example, for T4, one responded "*The amount of reading and guessing where the words "simple concept" would appear was time consuming which makes me feel the task was difficult*."

- Resource credibility (N=1)

For example, for T4, one responded "*This task was only difficult because I wanted to make sure I was looking at valid sources*."

- Low level of search experience (N=2)

For example, for T4, one responded "*It was difficult because I was not familiar on the topic and I do not have much experience with the library database*."

- Not enough information (N=7)

For example, for T4, one responded "*There was not a lot of information available.*"

Summary of results

As can be seen, the main categories of the reasons why users think a task is difficult were the same before users worked with it compared to after. Figure 1 summarizes these reasons following the framework that we proposed earlier.

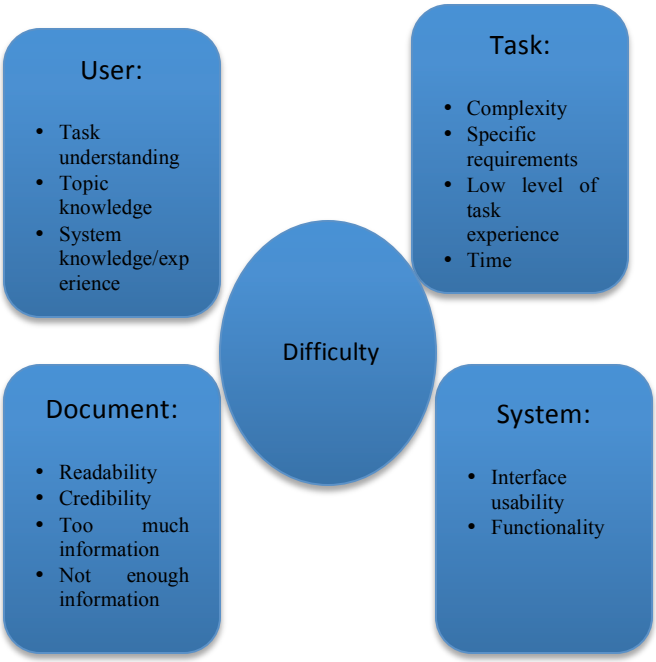

Figure 1. Factors leading to task difficulty

DISCUSSION

Various approaches have been attempted in information system design to help users with their tasks, from different aspects: query (re)formulation, result (re)ranking, and interface features, etc. Our research findings here have implications on system design, at least in building systems that can reduce task difficulty level to users. The following lists some suggestions (see also Table 2):

User related:

For people with low levels of knowledge, the system may provide results that are easier to read and understand. Issues about readability have been discussed much in the literature about domain knowledge, e.g., Kumaran et al. (2009).

For people with low search experience, systems want to design the interface that are easy to learn, and easy to use. These have been much researched in the Human-Computer Interaction (HCI) area.

Task related:

If the task is complex, the system may help reduce the complexity level by decomposing them into different sub-tasks, for example, into parallel subtasks such as in Liu et al. (2011). Strategies can be providing query suggestions that cover different aspects of the task, or providing suggestions in the result page for decomposing tasks, and so on.

If the task has specific requirements that the system can detect from users' initial queries (such as some long queries using specific terms), the system may refine and/or expand the query by including all aspects of the query.

	Reasons for difficulty	**Examples of how systems can help**
User related	Low level of topic knowledge	Result page readability, etc.
	Low level of search experience	Interface easy to learn and use
	Understanding of task requirements	
Task related	Complexity	Reduce complexity levels
	Specific requirements	Query suggestion, etc.
	Low level of task experience	
	Time limitation	Decompose task
Resource related	Resource credibility	Link to credible sources, e.g., library database, catalog, etc.
	Readability	Result ranking according to user knowledge
	Too much information	Result (re)ranking
	Not enough information	
System related	System functionality	
	Interface usability	

Table 2. Task difficulty reason categories

Resource related:

Users want the sources they use to be credible, so putting the pages with higher credibility or authority to the lower ranks as much as possible would be a good strategy. In addition, if the users are searching for something scholarly related, giving links to library catalogs/databases would be a good idea.

System related:

No specific implications are suggested based on the case study, but a general note is that this involves improving systems' usability and functionality, which is the goal of many HCI and IR studies.

CONCLUSIONS

In this paper, we proposed a framework of why people feel an information task is difficult and examined the various reasons through a case study. Based on the results that were categorized into the four aspects in our framework, we suggested implications for system design that may help reduce task difficulty. Meanwhile, we want to note that the findings of this research are limited to some extent by the number of participants. Future research will increase the sample size, as well as examine more aspects that can improve the framework and provide more implications on system design. Future research will also examine the reasons for difficulty by different task types. In the long run, we will explore if there are relations between users behaviors and the different types of difficulty reasons, and if so, what. It is also in our plan to implement the suggested system enhancements and run follow-up studies.

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REFERENCES

1. Aula, A., Khan, R. & Guan, Z. (2010). How does search behavior change as search becomes more difficult? *Proceedings of CHI '10,* 35-44.
2. Carmel, D., Yom-Tov, E., Darlow, A., & Pelleg, D. (2006). What makes a query difficult? *SIGIR '06.*
3. Cronen-Townsend, S., Zhou, Y., & Croft, W. B. (2002). Predicting query performance. *SIGIR '02.*
4. Gwizdka, J. (2008). Task difficulty revisited. *Proceedings of ASIS&T '08.*
5. Kumaran, G, Jones, R., & Madani, O. (2005). Biasing Web search results for topic familiarity. In *Proceedings of CIKM '05*, 271-271.
6. Li, Y. & Belkin, N.J. (2008). A faceted approach to conceptualizing tasks in information seeking. *Inform Process Manag*, 44, 1822-1837.
7. Liu, J., Gwizdka, J., Liu C., & Belkin, N. J. (2010). Predicting task difficulty for different task types. *Proceedings of ASIS&T '10.*
8. Liu, J., Liu, C., Yuan, X., Belkin, N. (2011). Understanding searche1rs' perception of task difficulty: Relationships with task difficulty. *Proceedings of ASIS&T '11.*