

Characterizing the Stages of Complex Tasks

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ABSTRACT

Stage is an essential facet of task. At different stages of search, users' search strategies are often influenced by different search intentions, encountered problems, as well as knowledge states. In previous studies, information seeking and interactive IR researchers have developed and validated some frameworks for describing various task facets and features. However, few studies have explored how to depict and differentiate different stages or states of complex search tasks in a comprehensive, multidimensional manner. The existing theoretical models of search process offer limited contributions to search path evaluation and the design of system recommendations for users at different states. To address this issue at both theoretical and empirical levels, my dissertation aims to construct an explainable framework that can characterize the stages or states of complex search tasks over multiple dimensions and to apply the framework in proactive search path evaluation and recommendation.

CCS CONCEPTS

• **Information systems** → **Users and interactive retrieval.**

KEYWORDS

Complex task; Multidimensional task stage; Information searching

1 MOTIVATION

Tasks of different types often emerge from evolving, continuous problematic situations when people interact with various elements embedded in their life-worlds. Search systems and technologies have experienced phenomenal success in recent years, especially in addressing fact-finding and navigational search tasks [6]. However, current search systems, interaction models, and the underlying algorithms still face plenty of challenges when applied in supporting *complex tasks* which involve multi-round, multidimensional search interactions and iterations (e.g., planning a research project, evaluating retirement packages) [1]. One of the major challenges in facilitating complex task is understanding and supporting the implicit task stages or states in search interactions.

2 RESEARCH QUESTIONS AND METHODS

The ultimate goal of this dissertation is to establish a multidimensional framework that can (1) characterize the stages or states of complex search tasks and (2) facilitate the evaluation of search

actions and strategies as well as proactive search paths recommendations. Specifically, based on our recent research progresses on users' intentions, problems, and task-based search interactions (e.g., [2–4]), this work seeks to answer the following questions:

- **RQ1** What are the stages of complex search tasks in terms of query-level search intentions, encountered problems, and search tactics?
- **RQ2** What are the relations between different task stages?
- **RQ3** How can we evaluate a search path using the multidimensional task stage framework?
- **RQ4** How can we proactively offer useful system supports *before* actual search problems and difficulties happen?

Given the nature of the above research questions, this dissertation work consists of two parts. The first part includes two *controlled lab studies* where I controlled task types and collected data on multiple dimensions of search from users (e.g., search intentions, encountered problems and preferred helps, search actions), aiming to characterize task stages from different perspectives and also to understand the underlying connections among various states (RQ1 & RQ2). A multidimensional stage framework of complex task will be constructed based on the findings from user studies as well as the relevant constructs from existing literature (e.g., Human problem solving [5]). The second part is a *large scale experiment* where I will run simulations based on the data collected from existing user studies and large-scale search logs and iteratively evaluate search paths as "users' policies in uncertain environments" using Reinforcement Learning approach. The proposed task stage framework will be employed to characterize the states, actions, and rewards in search paths. Finally, I will approach RQ4 as a policy optimization problem for unknown Markov Decision Process (MDP) and evaluate the quality of improved policies as (simulated) recommendations.

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