Modelling User Search Behaviour Based on Process

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ABSTRACT

Typically, interactive information retrieval (IIR) system evaluations assess search processes and outcomes using a combination of two types of measures: 1. user perception (e.g. users' attitudes of the search experience and outcome); 2. user behaviour (e.g. time and counts of various actions including mouse and keyboard clicks). In general, we assume that they are indicative of the search outcomes (e.g. performance, opinion).

However, search is a dynamic process with changing outcomes. Therefore, neither measure solely provides a holistic way of evaluating search. On one hand, user behaviour measures are only descriptive of the outcome, and are not interpretive of the process. That is to say, they lack the rationale behind why those behaviours occurred. Another problem is that some mental activities may not reflect on user behaviour [1]. The challenge with logfiles, which contain behaviour data, is the voluminous number of data points and the need to find a reliable approach to define groups or sets based on behavioural patterns. Not all users are alike and nor do they all take the same approach to search for the same things, as evidenced by the TREC, INEX and CLEF interactive tracks. On the other hand, user perception measures are acquired in such small samples that do not scale to large participant populations, and are rarely measured constantly due to the laborious and time consuming data collection methods (e.g. questionnaire, interview). Moreover, not enough emphasis is put on assessing the reliability of individual perception measures, and the wide usage of likert-type scale limits the interpretation of answers. For a holistic understanding of the search process, we need both perception and behaviour measures. I speculate that user behaviour may predict user perception, and thus we should be able to analyse large-scale files for a greater understanding of the likely human responses.

This problem is a pervasive one that exists from small projects to large organisations. In addition, the evaluation of search systems based on the *entire search process* has not been investigated adequately. Although some models (e.g. Marchionini's model [3]) of the search process fits real-life search, it is still considered fundamental in describing mental activities in the search process, and the seemingly random iterations of mental status is not easily accessible. Previous studies (e.g. [5]) have used a short piece of action sequence to represent search trail, but it was measured in a short time period, rather than covering the whole search process.

The purpose of this research is to investigate the relationship between user perception and user behaviour during search;

identify behaviour patterns across users' search process; investigate the validity of behavioural patterns and whether the patterns are indicative of user perception, which further implicate trends for either search success or failure. We will address the following research questions: *Q1. Which user behaviour measures are indicative of user perception? Q2. What behaviour patterns are represented in the search process when users use search systems for work task completion? Q3. What are the behaviour patterns of search process when users do not have a clear search task in mind (exploratory search)? Q4. How could these behaviour patterns be used to understand and produce a predictive model of user perception?*

The datasets I propose to use contain both user behaviour data from logfiles and user perception data from the results of the User Engagement Scale [4], which were collected in previous studies, and they covered different task types. Tackling such problems requires a mix of user- and system-centred approaches, and pattern recognition methodologies, such as time series analysis and Hidden Markov Model [2], will be applied. Our preliminary test [6] showed that although aesthetics and usability perceptions of search appear un-influenced by users interactions with system, attention, involvement and novelty were associated with general actions. Ultimately, this research will augment the development of a predictive model of search success, as well as a more cost-efficient interactive information retrieval evaluation method that enables automated data collection of essential measures, that would benefit both users and search engine developers.

Keywords
Search process; user behaviour; interactive information retrieval evaluation

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