Investigation of Individual Differences in Gaze Behavior based upon Cognitive Function in Faceted Search Interfaces for Library Catalogs: Initial Results

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Motivation
This pilot study examines how searchers interact with a web-based, faceted library catalog when conducting exploratory searches.

Our objective is to better understand how these interfaces affect searcher actions, tactics, and strategies.

The pilot investigates important aspects of faceted search interface use, including:

- searcher gaze behavior (what components of the interface searchers look at); and
- how gaze behavior differs depending upon a searcher’s cognitive abilities.

Research Questions

Does gaze behavior differ for searchers who score high versus low on cognitive memory span tests?

H1: Searchers who score low on cognitive tests will have a larger number of fixations than searchers with high cognitive test scores.

The independent variable was total cognitive test score. The dependent variable was fixation count (the number of times a searchers looks at the major elements of the interface). This study helped answer the following question:

Cognitive Function Measures

Three tests were used to assess attention span of participants using the Kit of Factor-Referenced Cognitive Tests:

- MS-1 – Auditory Number Span Test
- MS-2 – Auditory Letter Span Test
- MS-3 – Visual Number Span Test

The cumulative score of the three tests was calculated for each participant. The median of the group’s total score was calculated as 27, with a lowest score of 15 and highest of 30.

Participants were categorized as having “Low” cognitive tests scores if they scored 27 or less and “High” if they scored greater than 27.

Exploratory Task – Academic paper research

Exploratory searches were situated in the context of preparing to do research for an undergraduate academic paper.

Method

- Single factor design, two-level between groups variable
- Six exploratory search tasks
- Two cognitive levels: High and Low
- N=6 convenience sample

Procedure

- Subjects conducted 6 exploratory searches in a modified version of the North Carolina State University (NCSU) library catalog.
- Subjects took three cognitive paper and pencil tests measuring auditory number, auditory letter, and visual number spans.
- A Tobii T120 eye tracker was used to collect gaze data and screen video.
- Each search results page was segmented into areas of interest (AOIs) based on interface elements (breadcrumbs, facets, query box, results). Total fixation times and fixation counts were computed for each AOI.

Results

- Pilot participants’ cognitive test scores tended to score closely together and cluster.
- Searchers in the Low cognitive score group had higher total fixation counts than searchers in the High cognitive score group (8,943 versus 4,843).
- Searchers in the Low cognitive score group experienced more cognitive difficulty with the search.

Conclusions and Next Steps*

Pilot participants’ clustered cognitive test scores suggest a need to recruit more broadly for a larger sample population with more diverse cognitive scores.

Searchers in the Low cognitive score group had higher fixation counts in facets, a possible indication that these searchers experienced more cognitive difficulty with the search.

Evidence that at least one participant rarely looked at the facets suggests there are individual differences in exploratory search task behavior.

*The sample size (n=6) was small. No statistical measures were calculated for this pilot study.