

Individual Differences in Internet Search Processes and Outcomes (Poster at CHI 2006)

Leo Gugerty, Craig Treadaway & James Rubinstein; Psychology Department; Clemson University, SC, USA; gugerty@clemson.edu



Purpose

Egan (1988) and others have shown that individual differences in cognitive abilities and prior experiences can affect performance of common computer tasks. This suggests the possibility of a "cognitive digital divide." The goal of this study was to understand how individual differences in:

- cognitive abilities,
- computer attitudes, &
- computer experience

affect:

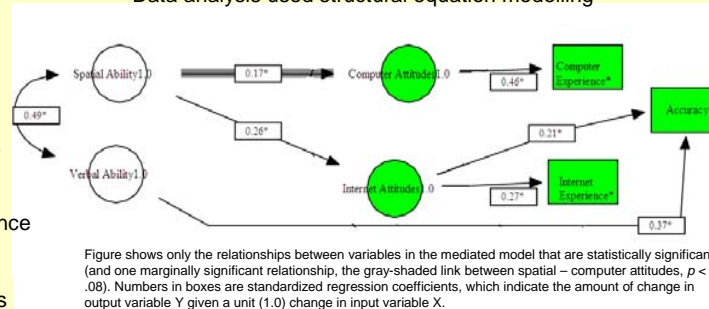
- internet search processes &
- search outcomes.

Individual Differences & Search Outcomes

- First analysis focused on how individual differences variables affected overall search **outcomes** – i.e., search accuracy and time (emphasis here is on accuracy)
- Based on findings of Vicente, Hayes & Williges (1987), a **mediated model** was hypothesized in which cognitive abilities affected computer & internet attitudes, which in turn affected computer & internet experience, which then affected search outcomes

Abilities → Attitudes → Experience → Outcomes

- Data analysis used structural equation modelling



Results:

- Full mediation not found
- Some mediated effects found:
 - Spatial ability affected computer & internet attitudes which affected computer & internet experience
 - Spatial ability affected internet attitudes which affected search accuracy
- Some direct effects found
 - Verbal ability affected search accuracy (strongest effect)

Conclusion re search outcomes:

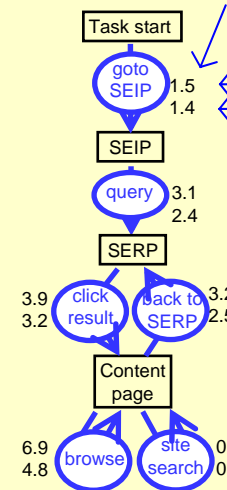
- Replicated findings that cognitive abilities and computer attitudes affect performance of important computer tasks

Individual Differences & Search Processes

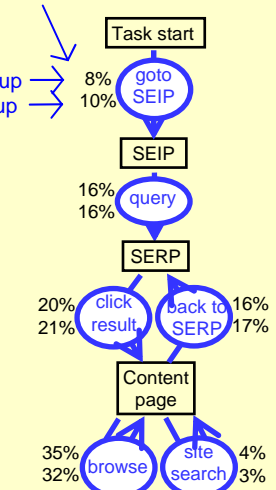
- Second (ongoing) analysis focuses on how individual differences variables affected overall search **processes**. One measure of search processes is:

- **Frequency of common search actions** – diagrams below show how often participants performed actions like going to a Search Engine Initial Page (SEIP), querying a search engine, returning to a Search Engine Results Page (SERP), and browsing on a content site. These diagrams are for one difficult search task – "What was the population of Mississippi in 1930?" Frequencies are shown in terms of the number of times an average participant took each action (**number of actions**) and the percentage of the average participant's actions devoted to each type of action (**percentage of all actions**). To begin to see how individual differences affected the frequency of these search actions, we divided participants into high-verbal (top 1/3) and low-verbal (bottom 1/3) groups.

Number of Actions



Percentage of All Actions



- The right diagram suggests that high- and low-verbal participants allocated similar percentages of their actions to the various common search tasks.
- The left diagram suggests that high-verbal participants performed more queries, clicked on more search results, and browsed to more pages than low-verbal participants. Verbal ability correlated significantly ($p < .05$) with the number of unique pages visited and the number of queries.
- No correlation between verbal ability and time to search. High-verbal group slightly more accurate (62% correct) than low-verbal group (52%); not significant ($p > .10$).
- **Interim summary of findings re search processes for this one task:** searchers with high verbal ability visited more pages & made more search-engine queries.

Methods

Participants

- 180 Clemson University undergraduates

Materials

- 7 tests of spatial & verbal ability
- survey of computer and internet experience
 - e.g., amount of experience with word processing, email, ...
- survey of computer and internet attitudes
 - e.g., degree of preference for computer activities
- Uzilla instrumented browser recorded internet search actions (A. Edmonds, 2003, www.uzilla.net)
 - Recorded URLs, queries, scrolling, timing

Procedure

- spatial and verbal tests completed
- 11 internet search tasks completed; for each:
 - search goal given on web page with links to 5 search engines
 - search goal always visible
 - when done, participants clicked 'complete' button and selected answer from a list
- attitude and experience surveys completed
- total time about 2.5 hours

References:

- Edmonds, A. (2003). Uzilla: A new tool for Web usability testing. *Behavior Research Methods, Instruments, & Computers*, 35 (2), 194 – 201.
- Egan, D. E. (1988). Individual differences in human-computer interaction. In Helander, M. (Ed.), *Handbook of Human-Computer Interaction*, 543 – 568.
- Vicente, K. J. & Williges, R. C. (1988). Accommodating individual differences in searching a hierarchical system. *International Journal of Man-Machine Studies*, 29, 647 – 668.