Studying the Use of Popular Destinations to Enhance Web Search Interaction

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Motivation

- Query suggestion is a popular approach to help users better define their information needs.
- May be inappropriate when needs are exploratory.
- In exploratory searches users rely a lot on browsing.
- Can we use places others go rather than what they say?

Query = [hubble telescope]
Search Trails

- Initiated with a query to a top-5 search engine

**Query trails**
- Query → Query

**Session trails**
- Query → Event:
  - Session timeout
  - Visit homepage
  - Type URL
  - Check Web-based email or logon to online service
Popular Destinations

Pages at which other users end up frequently after submitting the same or similar queries, and then browsing away from initially clicked search results.

Popular destinations lie at the end of many users’ trails
- May not be among the top-ranked results
- May not contain the queried terms
- May not even be indexed by the search engine

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<table>
<thead>
<tr>
<th>Measure</th>
<th>Query trails</th>
<th>Session trails</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of unique domains</td>
<td>2.0</td>
<td>4.3</td>
</tr>
<tr>
<td>Total page views</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All domains</td>
<td>4.8</td>
<td>16.2</td>
</tr>
<tr>
<td>Domains 1 to $(n–1)$</td>
<td>1.4</td>
<td>10.1</td>
</tr>
<tr>
<td>Domain $n$ (destination)</td>
<td>3.4</td>
<td>6.2</td>
</tr>
<tr>
<td>Total time spent (secs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All domains</td>
<td>172.6</td>
<td>621.8</td>
</tr>
<tr>
<td>Domains 1 to $(n–1)$</td>
<td>70.4</td>
<td>397.6</td>
</tr>
<tr>
<td>Domain $n$ (destination)</td>
<td><strong>102.3</strong></td>
<td><strong>224.1</strong></td>
</tr>
</tbody>
</table>
Suggesting Destinations

- Can we exploit a corpus of trails to support Web search?
Research Questions

- **RQ1**: Are destination suggestions preferable and more effective than query refinement suggestions and unaided Web search for:
  - Searches that are well-defined ("known-item" tasks)
  - Searches that are ill-defined ("exploratory" tasks)

- **RQ2**: Should destination suggestions be taken from the end of the query trails or the end of the session trails?
User Study

- Conducted a user study to answer these questions
- 36 subjects drawn from subject pool within our organization
- 4 systems
- 2 task types (“known-item” and “exploratory”)
- Within-subject experimental design
- Graeco-Latin square design
- Subjects attempted 2 known-item and 2 exploratory tasks, one on each system
Systems: Unaided Web Search

- Live Search backend
- No direct support for query refinement

Query = [hubble telescope]
Systems: Query Suggestion

- Suggests queries based on popular extensions for the current query type by the user

Query = [hubble telescope]
Systems: Destination Suggestion

- **Query Destination (unaided + page support)**
  - Suggests pages many users visit before next query

Query = [hubble telescope]

- **Session Destination (unaided + page support)**
  - Same as above, but before session end not next query
Tasks

- Tasks taken and adapted from TREC Interactive Track and QA communities (e.g., Live QnA, Yahoo! Answers)
- Six of each task type, subject chose without replacement
- Two task types: known-item and exploratory
  - **Known-item:** Identify three tropical storms (hurricanes and typhoons) that have caused property damage and/or loss of life.
  - **Exploratory task:** You are considering purchasing a Voice Over Internet Protocol (VoIP) telephone. You want to learn more about VoIP technology and providers that offer the service, and select the provider and telephone that best suits you.
Methodology

- Subjects:
  - Chose two known-item and two exploratory tasks from six
  - Completed demographic and experience questionnaire

- For each of four interfaces, subjects were:
  - Given an explanation of interface functionality (2 min.)
  - Attempt the task on the assigned system (10 min.)
  - Asked to complete a post-search questionnaire after each task

- After using four systems, subjects answered exit questionnaire
Findings: System Ranking

- Subjects asked to rank the systems in preference order

Relative ranking of systems (lower = better).

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<tr>
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<tbody>
<tr>
<td>Ranking</td>
<td>2.47</td>
<td>2.14</td>
<td>1.92</td>
<td>2.31</td>
</tr>
</tbody>
</table>

- Subjects preferred QuerySuggestion and QueryDestination
- Differences not statistically significant
- Overall ranking merges performance on different types of search task to produce one ranking
Findings: Subject Comments

Responses to open-ended questions

Baseline:

+ familiarity of the system (e.g., “was familiar and I didn’t end up using suggestions” (S36))
  – lack of support for query formulation (“Can be difficult if you don’t pick good search terms” (S20))
  – difficulty locating relevant documents (e.g., “Difficult to find what I was looking for” (S13))
Findings: Subject Comments

- **Query Suggestion:**
  - rapid support for query formulation (e.g., “was useful in saving typing and coming up with new ideas for query expansion” (S12); “helps me better phrase the search term” (S24); “made my next query easier” (S21))
  - suggestion quality (e.g., “Not relevant” (S11); “Popular queries weren’t what I was looking for” (S18))
  - quality of results they led to (e.g., “Results (after clicking on suggestions) were of low quality” (S35); “Ultimately unhelpful” (S1))
Findings: Subject Comments

**QueryDestination:**

+ support for accessing new information sources (e.g., “provided potentially helpful and new areas / domains to look at” (S27))
+ bypassing the need to browse to these pages (“Useful to try to ‘cut to the chase’ and go where others may have found answers to the topic” (S3))
- lack of specificity in the suggested domains (“Should just link to site-specific query, not site itself” (S16); “Sites were not very specific” (S24); “Too general/vague” (S28))
- quality of the suggestions (“Not relevant” (S11); “Irrelevant” (S6))
Findings: Subject Comments

- **SessionDestination:**
  - + utility of the suggested domains ("*suggestions make an awful lot of sense in providing search assistance, and seemed to help very nicely*" (S5))
  - – irrelevance of the suggestions (e.g., "*did not seem reliable, not much help*" (S30); "*irrelevant, not my style*" (S21))
  - – need to include explanations about why the suggestions were offered (e.g., "*low-quality results, not enough information presented*" (S35))
Findings: Task Completion

- Subjects felt that they were more successful for known-item searches on *QuerySuggestion* and more successful for exploratory searches in *QueryDestination*

<table>
<thead>
<tr>
<th>Task-type</th>
<th>System</th>
<th>Baseline</th>
<th>QSuggestion</th>
<th>QDestination</th>
<th>SDestination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Known-item</td>
<td>Baseline</td>
<td>2.0</td>
<td>1.3</td>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Exploratory</td>
<td>Baseline</td>
<td>2.8</td>
<td>2.3</td>
<td>1.4</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Perceptions of task success (lower = better, scale = 1-5)
Findings: Task Completion Time

- **QuerySuggestion** and **QueryDestination** sped up known-item performance.
- Exploratory tasks took longer.
Findings: Interaction

Suggestion uptake (values are percentages).

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</thead>
<tbody>
<tr>
<td></td>
<td>QSuggestion</td>
</tr>
<tr>
<td>Known-item</td>
<td>35.7</td>
</tr>
<tr>
<td>Exploratory</td>
<td>30.0</td>
</tr>
</tbody>
</table>

- Known-item tasks
  - subjects used query suggestion most heavily
- Exploratory tasks
  - subjects benefited most from destination suggestions
- Subjects submitted fewer queries and clicked fewer search results on QueryDestination
Conclusions

- Novel approach for enhancing users’ Web search interaction by providing links to websites frequently visited by other past searchers with similar information needs.
- User study compared the proposed technique with a traditional query refinement systems and unaided Web search.
- Results revealed that:
  - **RQ1a:** Query suggestion preferred for known-item tasks.
  - **RQ1b:** Destination suggestion preferred for exploratory tasks.
  - **RQ2:** Destinations from query trails rather than session trails.
- Popular destinations influenced search interactions in a way not achievable by query suggestion approaches.