The Effect of Search Task Familiarity on Search Behaviours in Biomedical Search

SIS Research Seminar

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Background

- Information retrieval for specialised domain; domain specific requirements
- Query formulation/reformulation as difficult search tasks
- Search task familiarity as important context factors in search
- Various techniques proposed to support users (e.g., relevance feedback, interactive query expansion and automatic suggestions)
- The impact of search task familiarity and term suggestion device on search behaviours and search performance rarely evaluated in interactive search environment
PubMed – Automatic Suggestions
PubMed – Automatic Term Mapping

Search Details

Query Translation:


Result:
121744

Translations:

<table>
<thead>
<tr>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>lung neoplasms[MeSH Terms] OR &quot;lung&quot;[All Fields] AND neoplasms[All Fields]</td>
</tr>
<tr>
<td>OR &quot;lung neoplasms&quot;[All Fields] OR &quot;lung&quot;[All Fields] AND &quot;cancer&quot;[All Fields]</td>
</tr>
<tr>
<td>OR &quot;lung cancer&quot;[All Fields] AND &quot;therapy&quot;[Subheading] OR &quot;therapy&quot;[All Fields]</td>
</tr>
<tr>
<td>OR &quot;treatment&quot;[All Fields] OR &quot;therapeutics&quot;[MeSH Terms] OR &quot;therapeutics&quot;[All Fields]</td>
</tr>
</tbody>
</table>

Database:
PubMed

User query:
lung cancer treatment
Research Question and Hypothesis

Q: What is the relationship between search task familiarity and search behaviours and search performance?

H: The experimental search interface with term suggestion based on MeSH co-occurrence information will be more effective for less familiar search requests.
Method – Search requests

• Genuine search requests
  • Users tend to grab search terms from pre-constructed topics
  • Motivated and engaged searchers
  • Search task familiarity
## Experimental design

- A repeated measures design

<table>
<thead>
<tr>
<th>Groups</th>
<th>PubMed</th>
<th>Experimental</th>
<th>PubMed</th>
<th>Experimental</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Familiar</td>
<td>Less familiar</td>
<td>Familiar</td>
<td>Less familiar</td>
</tr>
<tr>
<td>2</td>
<td>Less familiar</td>
<td>Familiar</td>
<td>Less familiar</td>
<td>Familiar</td>
</tr>
<tr>
<td>3</td>
<td>Familiar</td>
<td>Less familiar</td>
<td>Familiar</td>
<td>Less familiar</td>
</tr>
<tr>
<td>4</td>
<td>Less familiar</td>
<td>Familiar</td>
<td>Less familiar</td>
<td>Familiar</td>
</tr>
</tbody>
</table>
## Research procedure

<table>
<thead>
<tr>
<th>Instruments</th>
<th>Data collected</th>
</tr>
</thead>
</table>
| **Pre-search questionnaire**       | 1. Search statements  
|                                    | 2. Ideal query terms (pre-search)  
|                                    | 3. Numerical attributes characterizing search requests                        |
| **Search task; transaction log; screen capture** | 1. Query terms added, removed; # of submissions; # of pages viewed;  
|                                    | 2. 10 relevant records saved                                                  |
| **Post-search questionnaire**      | 1. Ideal query terms (post-search)  
|                                    | 2. ”Goodness” of their pre and post search query  
|                                    | 3. Relevance judgment of records saved  
|                                    | 4. Satisfaction with the search results  
|                                    | 5. Usefulness of the interfaces                                                |
Search interfaces

![Search interfaces for PubMed](https://example.com/search.png)

**MeSH terms displayed by classification**

<table>
<thead>
<tr>
<th>MeSH</th>
<th>Authors</th>
<th>Journal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatomy</td>
<td>Minna John D(51), Kira Katsuyuki(50)</td>
<td>Lung cancer (Amsterdam, Netherlands) (323)</td>
</tr>
<tr>
<td>Diseases</td>
<td>Shepherd Frances A(46), Tanimoto Mitsune(44)</td>
<td>Cancer research (384)</td>
</tr>
<tr>
<td>Tumor Cell Line</td>
<td>Gudziier Jim(36)</td>
<td>Journal of thoracic oncology: official publication of the International Association for the Study of Lung Cancer (314)</td>
</tr>
<tr>
<td>Cell Line</td>
<td>Tabata Masahiro(36)</td>
<td>Clinical cancer research: an official journal of the American Association for Cancer Research (278)</td>
</tr>
<tr>
<td>Lungs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liver</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Search Query**

- **Query**: Lung cancer

**Search Results**

- **PubMed**: 
- **Google Scholar**: 
- **Medline**: 

**Limiting Terms**

- **MeSH**: Anatomy, Diseases, Tumor Cell Line, Cell Line, Lymph, Persons, Respiratory System, Health Care, Liver
Search interfaces (cont’d)

MAP - Multi-faceted Access to PubMed

MeSH terms displayed by list

<table>
<thead>
<tr>
<th>MeSH</th>
<th>Signs and Symptoms Pathological Conditions</th>
<th>Access, and Evaluation Health Care Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic Techniques and Procedures</td>
<td>Men</td>
<td>Prognosis</td>
</tr>
<tr>
<td>Biopsy</td>
<td>Diagnostic Imaging</td>
<td>Surgery</td>
</tr>
<tr>
<td>Pathology</td>
<td>Women</td>
<td>Laboratory Techniques and Procedures</td>
</tr>
<tr>
<td>Cytology</td>
<td>Aged</td>
<td>Public Health</td>
</tr>
<tr>
<td>Histology</td>
<td>Health Care Evaluation Mechanisms</td>
<td>Neoplasms</td>
</tr>
<tr>
<td>Anatomy</td>
<td>Disease Management</td>
<td>Environment and Public Health</td>
</tr>
<tr>
<td>Adult</td>
<td>Quality of Health Care</td>
<td>Pathologic Processes</td>
</tr>
<tr>
<td>Sex Groups</td>
<td>Patients</td>
<td>Causality</td>
</tr>
<tr>
<td>Persons</td>
<td>Middle Aged</td>
<td>Methods</td>
</tr>
</tbody>
</table>

Author:

- Minna John D(51)
- Kiera Katsumi(50)
- Shepherd Frances A(46)
- Tanimoto Mitsunori(44)
- Fujisawa Takehiko(38)
- Gazdar Ali F(37)
- Johnson David H(37)
- Gandara David R(36)
- Tabata Masahiro(36)
- Komiaki Masakazu(36)

Journal:

- Lung cancer (Amsterdam, Netherlands) (523)
- Cancer research (384)
- Journal of thoracic oncology : official publication of the International Association for the Study of Lung Cancer (314)
- Clinical cancer research : an official Journal of the American Association for Cancer Research (278)
Search interfaces (cont’d)
Sources and mechanism for MeSH term suggestion

1. **Past 2 years**
   - Co-occurrence information of MeSH

2. **Top 200 MeSH terms**
   - Ranked by Co-occurrence x IDF

3. **PubMed**
   - Automatic translation table

4. **In MeSH?**
   - Yes
   - No

5. **Lung cancer**

6. **Neoplasm, lung**

7. **Top 200 Medline records**
   - Ranked by IDF

8. **Term Suggestion**
Results

• User backgrounds and characteristics
  • Most participants search PubMed at least once a week
  • Participants rarely use advanced search functions

• Search request characteristics
  • A total of 88 search requests (44 participants x 2 requests)
  • 60 revisits; 28 new searches
  • New vs. revisited searches are good indicators of search task familiarity
Results (cont’d)

Table 3. Search request characteristics (on a 0 to 6 scale)

<table>
<thead>
<tr>
<th>Search request</th>
<th>Mean (SD)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Familiarity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unfamiliar</td>
<td>1.50 (1.20)</td>
<td>28</td>
</tr>
<tr>
<td>Familiar</td>
<td>4.50 (1.55)</td>
<td>60</td>
</tr>
<tr>
<td>Completeness needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unfamiliar</td>
<td>3.07 (1.76)</td>
<td>28</td>
</tr>
<tr>
<td>Familiar</td>
<td>4.55 (1.05)</td>
<td>60</td>
</tr>
<tr>
<td>Suitability for delegation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unfamiliar</td>
<td>3.04 (1.32)</td>
<td>28</td>
</tr>
<tr>
<td>Familiar</td>
<td>2.80 (1.44)</td>
<td>60</td>
</tr>
<tr>
<td>Original “goodness” of query</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unfamiliar</td>
<td>3.61 (1.52)</td>
<td>28</td>
</tr>
<tr>
<td>Familiar</td>
<td>3.95 (1.20)</td>
<td>60</td>
</tr>
</tbody>
</table>
Results (cont’d)

• Query behaviours
  • Users’ final queries diverged from the original queries when using the experimental search interface
  • Familiar searches were relatively stable and less likely to change after search interaction
Results (cont’d)

Figure 4: Performance criteria as functions of interface and search familiarity
Results (cont’d)

• Term suggestion interface did significantly better in terms of the final “goodness” of the query
• Term suggestion interface was perceived more useful, especially for new searches
• No interface main effect for satisfaction with results; Search interface-familiarity interaction effect was significant
• No significant effect for relevance scores
• Overall, term suggestion interface was more useful for unfamiliar searches
Discussion

• Querying behaviour affected by the experimental search interface (MAP)
• Search task familiarity as important dimension of user search contexts
• Benefits of experimental search interface for unfamiliar searches
• Consideration of search request characteristics in evaluation of interactive IR system
• Methodological issue of carry-over effect; collaborative IR settings
Conclusion

• The effectiveness of the query expansion methods might depend on the nature of search tasks

• Search task familiarity as important factor for interactive IR evaluation
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For more details, please see

*International Journal of Medical Informatics, 82*(9), 832-843.

Thank You!

Questions or Comments?