

# Studying the Use of Popular Destinations to Enhance Web Search Interaction

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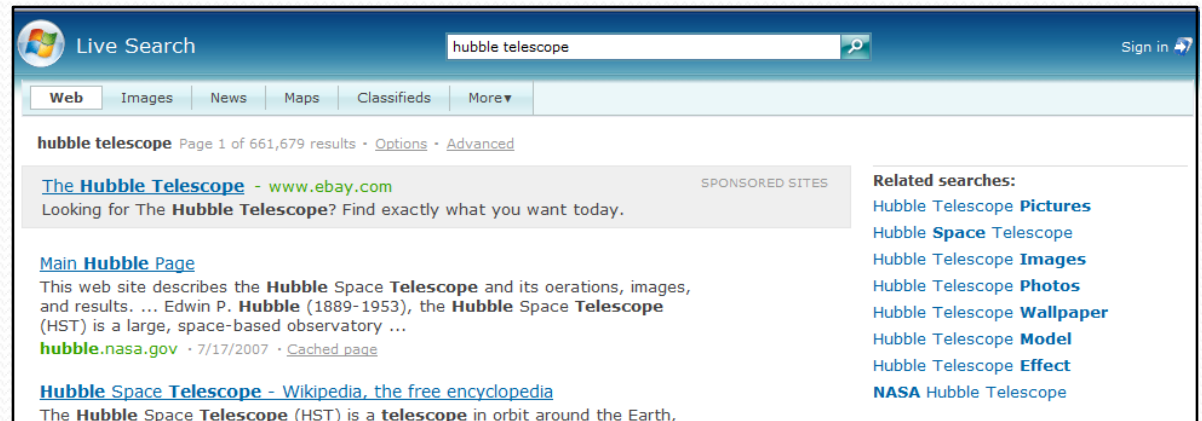
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# Motivation

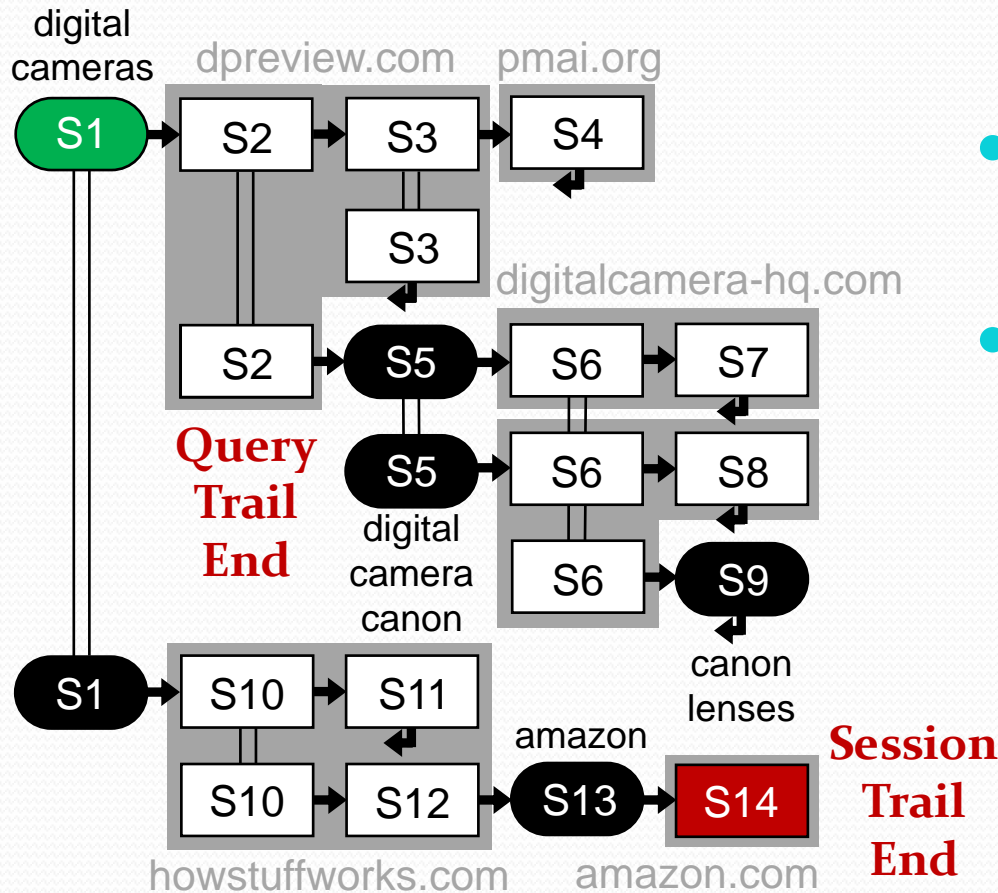
- Query suggestion is a popular approach to help users better define their information needs

Query = [hubble telescope]



- 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?

# 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

Measure		Query trails	Session trails
Number of unique domains		<b>2.0</b>	<b>4.3</b>
Total page views	All domains	4.8	16.2
	Domains 1 to $(n - 1)$	1.4	10.1
	Domain $n$ (destination)	<b>3.4</b>	<b>6.2</b>
Total time spent (secs)	All domains	172.6	621.8
	Domains 1 to $(n - 1)$	70.4	397.6
	Domain $n$ (destination)	<b>102.3</b>	<b>224.1</b>

- **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

# Suggesting Destinations

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

Results 1-10 of 661,679 for hubble telescope. Query Destination Suggestion

**Main Hubble Page**  
This web site describes the Hubble Space Telescope and its operations, images, and results. ... Edwin P. Hubble (1889-1953), the Hubble Space Telescope (HST) is a large, space-based observatory ...  
[hubble.nasa.gov](http://hubble.nasa.gov)

**Hubble Space Telescope - Wikipedia, the free encyclopedia**  
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[en.wikipedia.org/wiki/hubble\\_space\\_telescope](http://en.wikipedia.org/wiki/hubble_space_telescope)

**HubbleSite -- Out of the ordinary...out of this world.**  
Located at the Space Telescope Science Institute, goal is to work on studying and explaining the unique, celestial phenomena, which is now made visible using Hubble's advanced technology.  
[hubblesite.org](http://hubblesite.org)

**HubbleSite - Gallery**  
SPACECRAFT HUBBLE image gallery See the telescope floating through its celestial environment and view astronauts, astronomers, and engineers at work.  
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**E/PO at STScI**  
Cool pictures, news, discoveries, and technology from NASA's Hubble Space Telescope. Go there...  
[oposite.stsci.edu](http://oposite.stsci.edu)

**Search Signposts**

Query	Destination
Popularity	
	<a href="http://hubblesite.org">hubblesite.org</a>
	<a href="http://space.com">space.com</a>
	<a href="http://en.wikipedia.org">en.wikipedia.org</a>
	<a href="http://heritage.stsci.edu">heritage.stsci.edu</a>
	<a href="http://telescope.com">telescope.com</a>
	<a href="http://library.thinkquest.org">library.thinkquest.org</a>

# Research Questions

- **RQ<sub>1</sub>**: 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)
- **RQ<sub>2</sub>**: Should destination suggestions be taken from the end of the query trails or the end of the session trails?

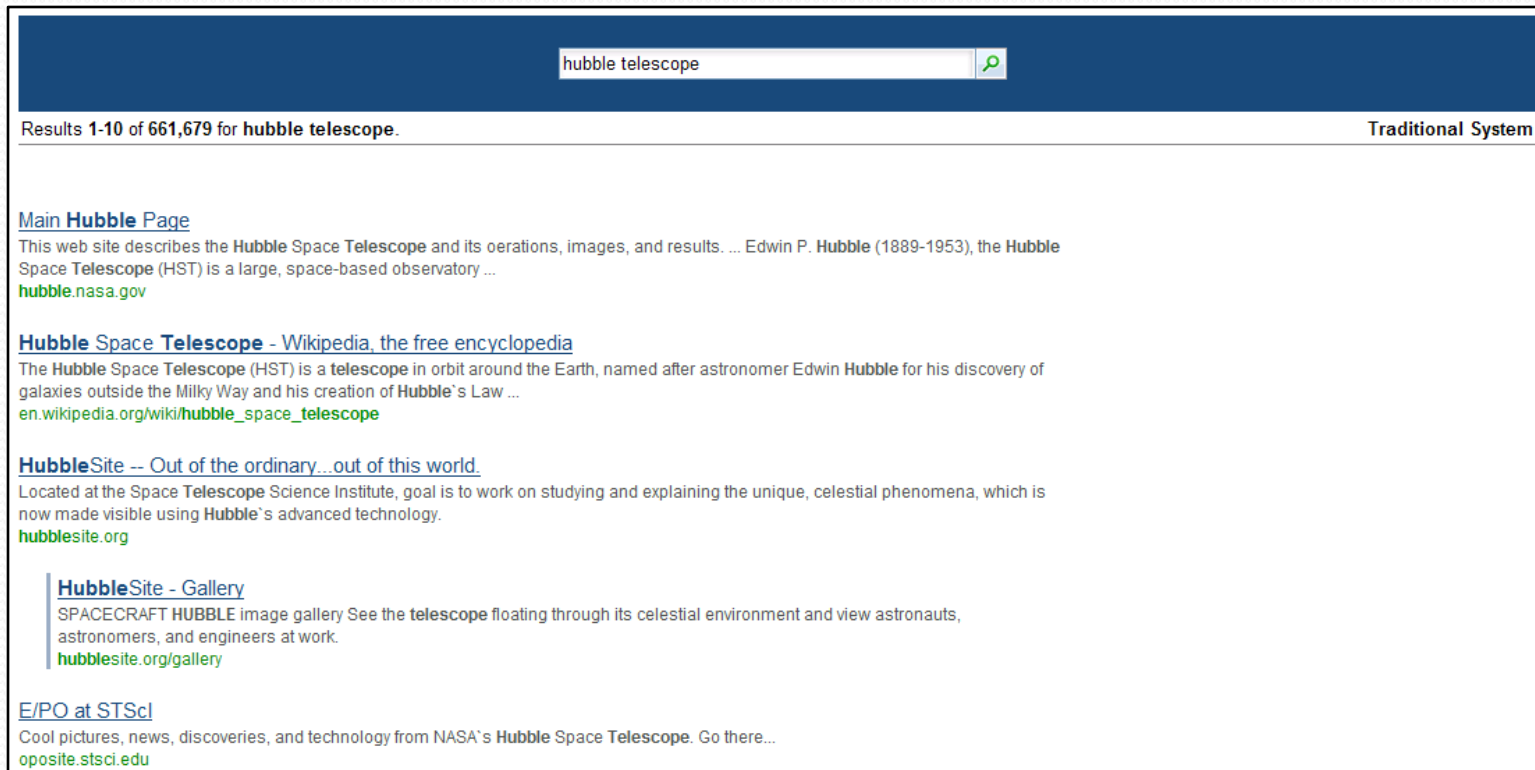
# User Study

- 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]**



The screenshot shows a search engine interface with a search bar containing the text "hubble telescope" and a magnifying glass icon. Below the search bar, the results are displayed. The first result is "Main Hubble Page" with a description of the Hubble Space Telescope and its operations, including a link to "hubble.nasa.gov". The second result is "Hubble Space Telescope - Wikipedia, the free encyclopedia" with a description of the HST and its discovery of galaxies outside the Milky Way, including a link to "en.wikipedia.org/wiki/hubble\_space\_telescope". The third result is "HubbleSite -- Out of the ordinary...out of this world." with a description of the Space Telescope Science Institute and its goal to study and explain celestial phenomena, including a link to "hubblesite.org". There is also a section for "HubbleSite - Gallery" with a description of the SPACECRAFT HUBBLE image gallery and a link to "hubblesite.org/gallery". The final result is "E/PO at STScI" with a description of cool pictures, news, discoveries, and technology from NASA's Hubble Space Telescope, including a link to "oposite.stsci.edu".

Results 1-10 of 661,679 for **hubble telescope**. Traditional System

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# Systems: Query Suggestion

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

**Query = [hubble telescope]**

The screenshot shows a search interface with a search bar containing 'hubble telescope'. Below the search bar, it displays 'Results 1-10 of 661,679 for hubble telescope.' and a 'Query Suggestion System' section. The main content area lists several search results, each with a title, a brief description, and a URL. On the right side, there is a 'Search Signposts' section with a table of related searches.

Results 1-10 of 661,679 for **hubble telescope**. Query Suggestion System

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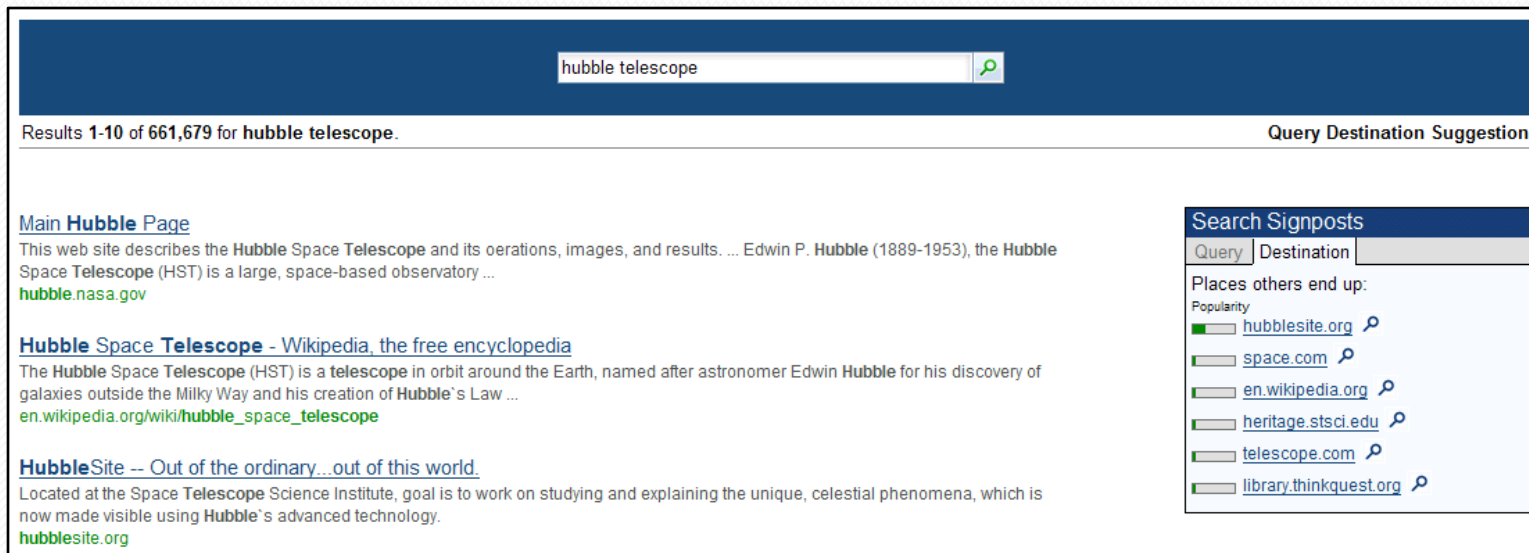
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Search Signposts	
Query	Destination
Related searches:	
Popularity	
<input type="checkbox"/>	Hubble Pictures
<input type="checkbox"/>	Hubble Telescope History
<input type="checkbox"/>	Hubble Telescope Information
<input type="checkbox"/>	Hubble Space Pictures
<input type="checkbox"/>	Hubble Scope
<input type="checkbox"/>	Hubble Spacecraft Pictures

# Systems: Destination Suggestion

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

**Query = [hubble telescope]**



The screenshot shows a search engine interface with a search bar containing 'hubble telescope'. Below the search bar, it displays 'Results 1-10 of 661,679 for hubble telescope.' and 'Query Destination Suggestion'. The main results area lists three items:

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On the right side, there is a 'Search Signposts' sidebar with a 'Query' field containing 'hubble telescope' and a 'Destination' field. Below this, it lists 'Places others end up:' with a 'Popularity' bar for each item:

- [hubblesite.org](http://hubblesite.org)
- [space.com](http://space.com)
- [en.wikipedia.org](http://en.wikipedia.org)
- [heritage.stsci.edu](http://heritage.stsci.edu)
- [telescope.com](http://telescope.com)
- [library.thinkquest.org](http://library.thinkquest.org)

- **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).

Systems	Baseline	QuerySuggest.	QueryDest.	SessionDest.
Ranking	2.47	<b>2.14</b>	<b>1.92</b>	2.31

- 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))

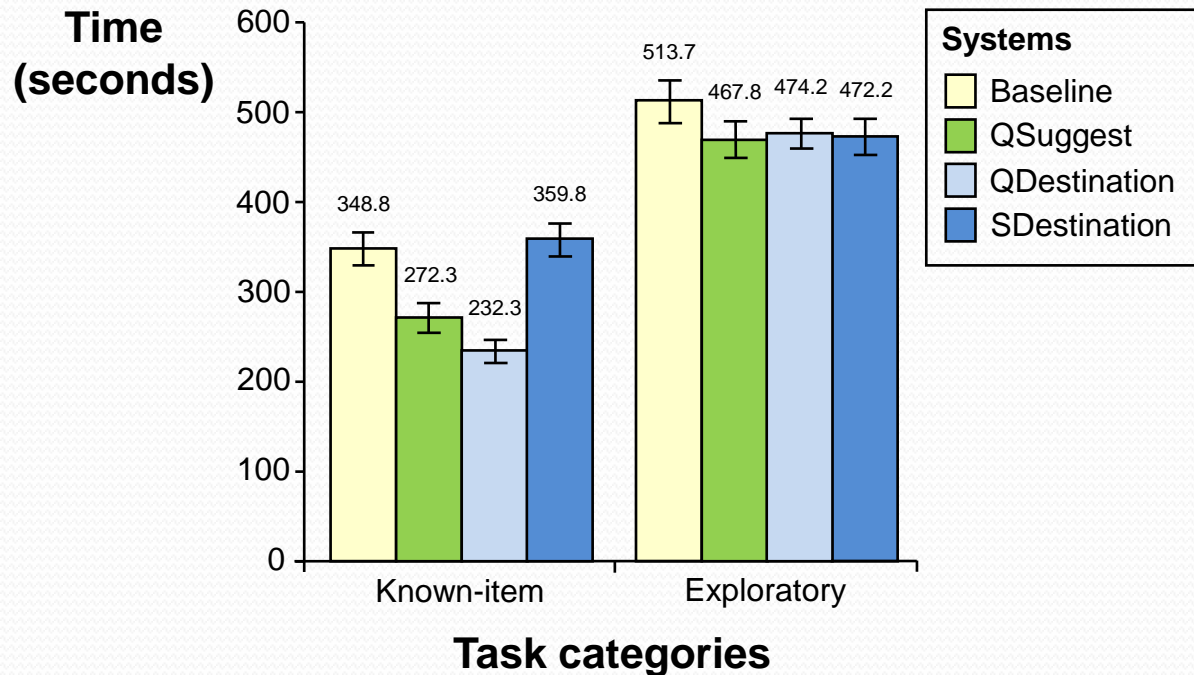
# Findings: Task Completion

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

Perceptions of task success (lower = better, scale = 1-5 )

Task-type	System			
	Baseline	Q suggestion	QDestination	SDestination
Known-item	2.0	<b>1.3</b>	<b>1.4</b>	<b>1.4</b>
Exploratory	2.8	2.3	<b>1.4</b>	2.6

# Findings: Task Completion Time



- *QuerySuggestion* and *QueryDestination* sped up known-item performance
- Exploratory tasks took longer

# Findings: Interaction

Suggestion uptake (values are percentages).

Task-type	System		
	Q Suggestion	Q Destination	S Destination
Known-item	<b>35.7</b>	33.5	23.4
Exploratory	30.0	<b>35.2</b>	25.3

- 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