

Studying the Use of Popular Destinations to Enhance Web Search Interaction

Ryen W. White, Mikhail Bilenko, Silviu Cucerzan
Microsoft Research, Redmond, USA
{ryenw, mbilenko, silviu}@microsoft.com

Motivation

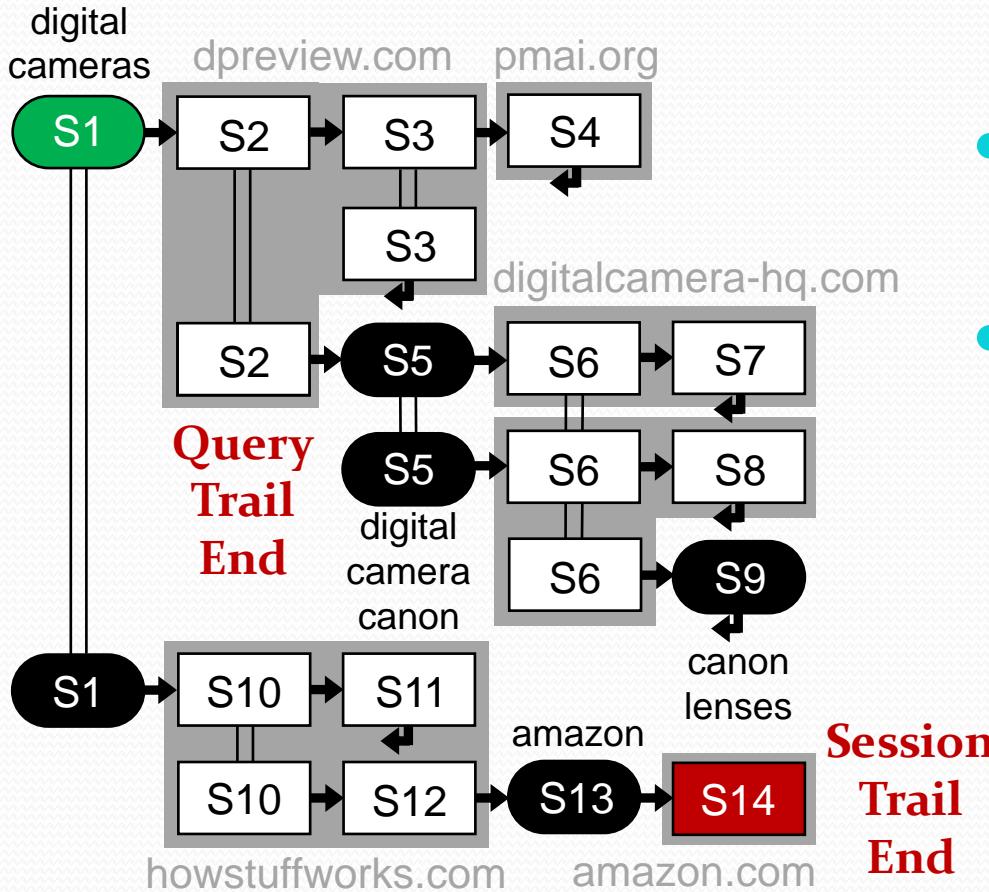
- Query suggestion is a popular approach to help users better define their information needs

Query = [hubble telescope]

The screenshot shows a search results page for "hubble telescope" on Live Search. The results include a sponsored link from eBay for "The Hubble Telescope" and a main search result for the "Main Hubble Page" which describes the Hubble Space Telescope and its operations. There is also a link to the "hubble.nasa.gov" website. To the right, there is a sidebar titled "Related searches" with links to "Hubble Telescope Pictures", "Hubble Space Telescope", "Hubble Telescope Images", "Hubble Telescope Photos", "Hubble Telescope Wallpaper", "Hubble Telescope Model", "Hubble Telescope Effect", and "NASA 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		2.0	4.3
Total page views	All domains	4.8	16.2
	Domains 1 to $(n - 1)$	1.4	10.1
	Domain n (destination)	3.4	6.2
Total time spent (secs)	All domains	172.6	621.8
	Domains 1 to $(n - 1)$	70.4	397.6
	Domain n (destination)	102.3	224.1

- **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?

The screenshot shows a search interface with the query "hubble telescope" in the search bar. Below the search bar, it says "Results 1-10 of 661,679 for hubble telescope." On the right side, there is a sidebar titled "Query Destination Suggestion" which lists "Search Signposts" and "Places others end up:".

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

Hubble Space Telescope - Wikipedia, the free encyclopedia
The Hubble Space Telescope (HST) is a telescope in orbit around the Earth, named after astronomer Edwin Hubble for his discovery of galaxies outside the Milky Way and his creation of Hubble's Law ...
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

HubbleSite - Gallery
SPACECRAFT HUBBLE image gallery See the telescope floating through its celestial environment and view astronauts, astronomers, and engineers at work.
hubblesite.org/gallery

E/PO at STScI
Cool pictures, news, discoveries, and technology from NASA's Hubble Space Telescope. Go there...
eppo.stsci.edu

Search Signposts
Query | Destination
Places others end up:
Popularity
[hubblesite.org](#) ↗
[space.com](#) ↗
[en.wikipedia.org](#) ↗
[heritage.stsci.edu](#) ↗
[telescope.com](#) ↗
[library.thinkquest.org](#) ↗

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]

The screenshot shows a search results page with a dark blue header bar. The search bar contains the query "hubble telescope" and a magnifying glass icon. Below the header, a message says "Results 1-10 of 661,679 for hubble telescope." On the right side of the header, it says "Traditional System".

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oposite.stsci.edu

Systems: Query Suggestion

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

Query = [hubble telescope]

hubble telescope 

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

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Query Suggestion System

Search Signposts

Query	Destination
Related searches:	
Popularity	
 Hubble Pictures	
 Hubble Telescope History	
 Hubble Telescope Information	
 Hubble Space Pictures	
 Hubble Scope	
 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 results page with a dark blue header bar. In the header bar, there is a search input field containing "hubble telescope" and a magnifying glass icon. Below the header, a message says "Results 1-10 of 661,679 for hubble telescope." To the right of this message is a link labeled "Query Destination Suggestion".

The main content area displays three search results:

- Main Hubble Page**: A brief description of the Hubble Space Telescope and its operations, mentioning Edwin P. Hubble (1889-1953). It includes a link to hubble.nasa.gov.
- Hubble Space Telescope - Wikipedia, the free encyclopedia**: A brief description of the Hubble Space Telescope (HST) as a telescope in orbit around the Earth, named after astronomer Edwin Hubble for his discovery of galaxies outside the Milky Way. It includes a link to en.wikipedia.org/wiki/hubble_space_telescope.
- HubbleSite -- Out of the ordinary...out of this world.**: A brief description of the HubbleSite, located at the Space Telescope Science Institute, which is now made visible using Hubble's advanced technology. It includes a link to hubblesite.org.

To the right of the search results is a sidebar titled "Search Signposts". It has two input fields: "Query" and "Destination". Below these fields is a section titled "Places others end up:" with a heading "Popularity". It lists several websites with small icons and links:

- hubblesite.org ↗
- space.com ↗
- en.wikipedia.org ↗
- heritage.stsci.edu ↗
- telescope.com ↗
- 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	2.14	1.92	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)*)

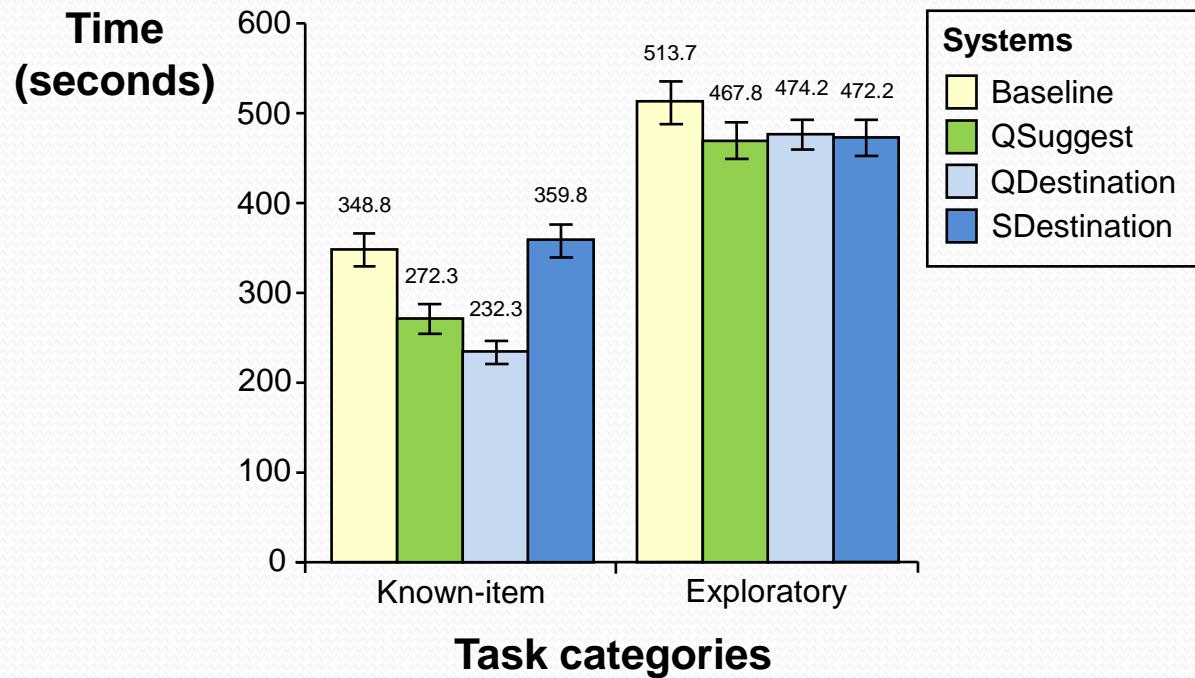
Findings: Task Completion

- 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	QSuggestion	QDestination	SDestination
Known-item	2.0	1.3	1.4	1.4
Exploratory	2.8	2.3	1.4	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		
	QSuggestion	QDestination	SDestination
Known-item	35.7	33.5	23.4
Exploratory	30.0	35.2	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