IS2140 Information Storage and Retrieval

Unit 8: Interactive IR

Daqing He
School of Information Sciences
University of Pittsburgh

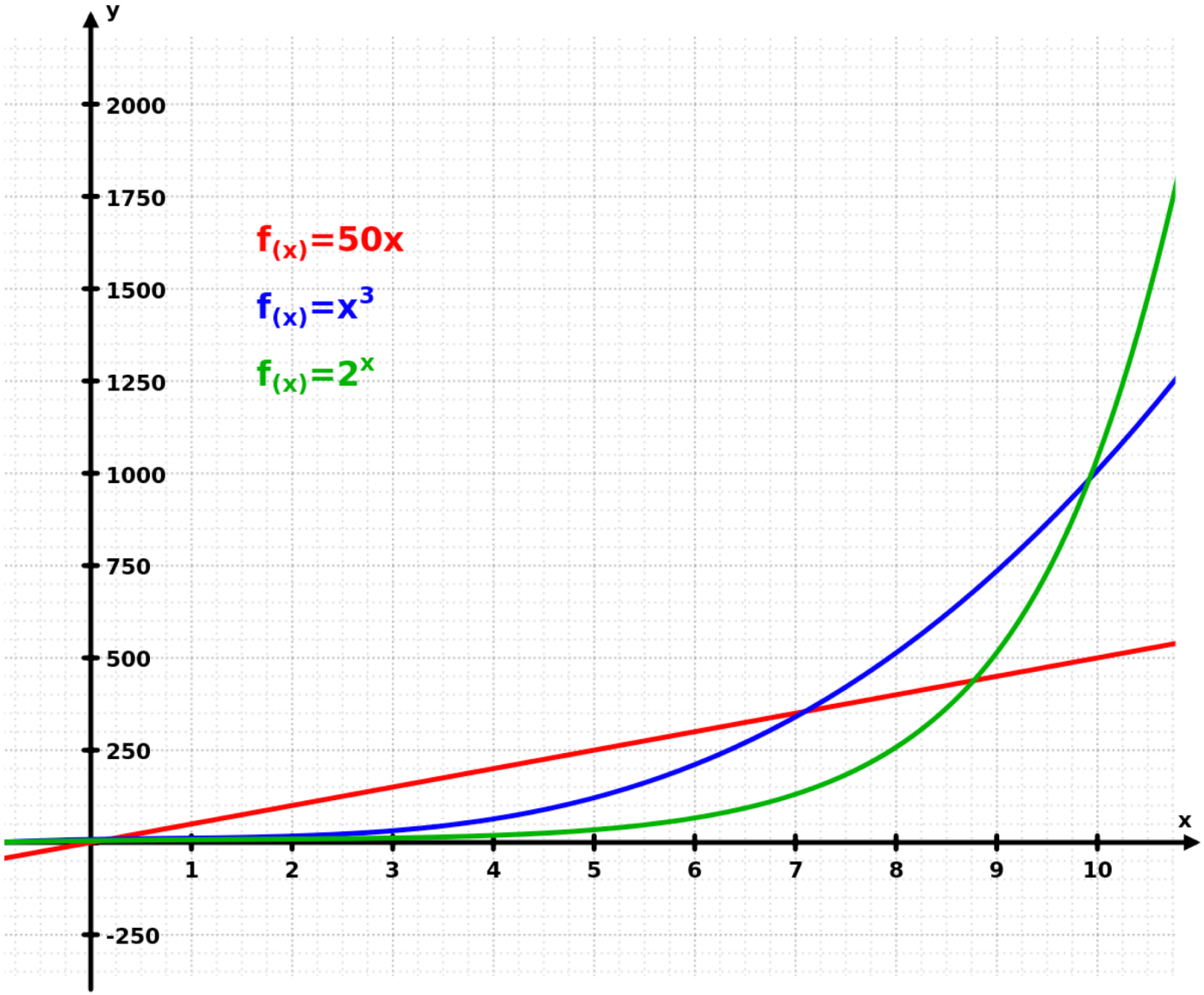
October 22, 2018

Muddiest Points

- Evaluation
  - How do we judge whether the system is good or not when users perform different qualities of queries, some queries with high relevance results and the others with low relevance results?
  - When we calculate the mean average precision(MAP) for a search engine, we use the average precision for each query result and then calculate the mean value as the MAP. But why is the ranking of each retrieval result be different if the ranking algorithm within the search engine is the same?

Muddiest Points

- Evaluation Measures
  - I think the measurements for precision and ranked retrieval are very interesting, but I didn't catch the answer for which type of search best suits each measurement.
  - Precision at fixed rank points is unfair for different queries, so how can we determine the the rank point for a query?
  - In discounted cumulative gain (DCG), we discount each result document's graded relevance based on the ranking. Mathematically, why do we use the exponential function as the numerator instead of linear function? Why don't we just say the discounted gain for a document i is rel(i)/log2(1+i)?


y
2000
1750
1500
1250
1000
750
500
250
-250
x
1
2
3
4
5
6
7
8
9
10
f(x)=50x
f(x)=x3
f(x)=2x

Muddiest Points

- Evaluation Measures
  - In the slide of page 22. The Precision decreates 0.5 for the second item when it fails to predict the first one correctly. But this doesn't apply to recall. Can I interpret the changes of recall and precision in this way that the ranking level has more impact on the precision than on the recall?
  - When we use the MAP as evaluation, can I see the area under the curve(on slides P16) as the score? Is the area larger the performance better?
    - https://datascience.stackexchange.com/questions/806/advantages-of-auc-vs-standard-accuracy

Muddiest Points

- Relevance
  - How to determine the threshold of relevance? Or how to determine the threshold of average precision value?
  - About "Aboutness" and "Usefulness", there are some ways measuring "aboutness", but how to measure if we only concerns about "usefulness"?
  - Has anyone found value in incorporating feedback that is richer than a binary 'relevant' or 'not relevant'? For example, with a multi-term query a document could be relevant to one of the terms but not the other. Or one could incorporate feedback along other dimensions than relevance, like whether a document is authoritative or whether it's targeted at entry-level vs expert readers in a topic.

Muddiest Points

- Implicit Relevance Feedback
  - In implicit feedback, can we return different top k relevant terms based on the users' demonstrated interest.
  - Could we use implicit feedback to evaluate the results when the ground truth is not available?

Agenda

- What is Interactive Information Retrieval
- Design for Interactive Information Retrieval
- Query Formulation and Reformulation
- Result Presentation
- Mobile Web Search
- Evaluate Interactive Information Retrieval Systems

Learning Objectives

- Clarifying the characteristics of interactive information retrieval, distinguishing it from static IR;
- Illustrating the design principles in IIR systems;
- Recognizing the interactive features in a search system
- Classifying the methods to evaluate an IIR system;
- Comparing and evaluating IIR systems.

Relevance Feedback

Types of Relevance Feedback

- Interactive relevance feedback: feedback information obtained from the user
  - Explicit relevance feedback
    - users explicitly mark relevant and irrelevant documents in the search results
    - We have shown the examples
  - Implicit relevance feedback
    - system attempts to infer user intentions based on observable behavior
- Blind relevance feedback or pseudo relevance feedback
  - feedback in absence of any evidence, explicit or otherwise
  - System assumes that the top ranked documents as relevant docs

Pseudo Relevance Feedback

- Also called blind relevance feedback
  - Avoid obtain user explicit or implicit feedback information
  - Use top returned N docs in the initial result for RF
  - Assume all of them are relevant

Any problem of this?

Does Pseudo RF Work?

- A study by Jimmy Lin
- Retrieval engine: Indri
- Test collection: TREC, topics 301-450
- Procedure:
  - Used topic description as query to generate initial hit list
  - Selected top 20 terms from top 20 hits using *tf.idf*
  - Added these terms to the original query

Pseudo RF Example

Number: 303
Title: Hubble Telescope Achievements

Description:
Identify positive accomplishments of the Hubble telescope since it was launched in 1991.

Narrative:
Documents are relevant that show the Hubble telescope has produced new data, better quality data than previously available, data that has increased human knowledge of the universe, or data that has led to disproving previously existing theories or hypotheses. Documents limited to the shortcomings of the telescope would be irrelevant. Details of repairs or modifications to the telescope without reference to positive achievements would not be relevant.

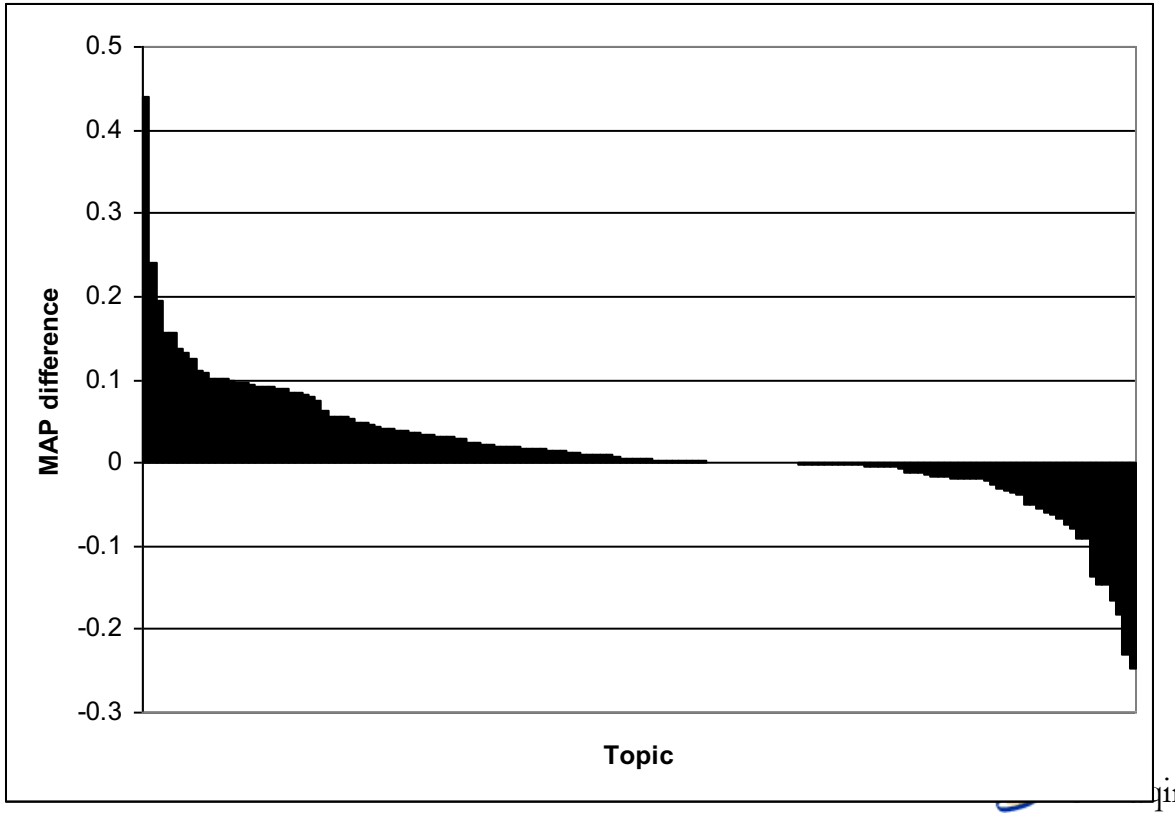
Terms added

telescope	1041.33984032195
hubble	573.896477205696
space	354.090789112131
nasa	346.475671454331
ultraviolet	242.588034029191
shuttle	230.448255669841
mirror	184.794966339329
telescopes	155.290920607708
earth	148.865466409231
discovery	146.718067628756
orbit	142.597040178043
flaw	141.832019493907
scientists	132.384677410089
launch	116.322861618261
stars	116.205713485691
universe	114.705686405825
mirrors	113.677943638299
light	113.59717006967
optical	106.198288687586
species	103.555123536418

Experiment Results

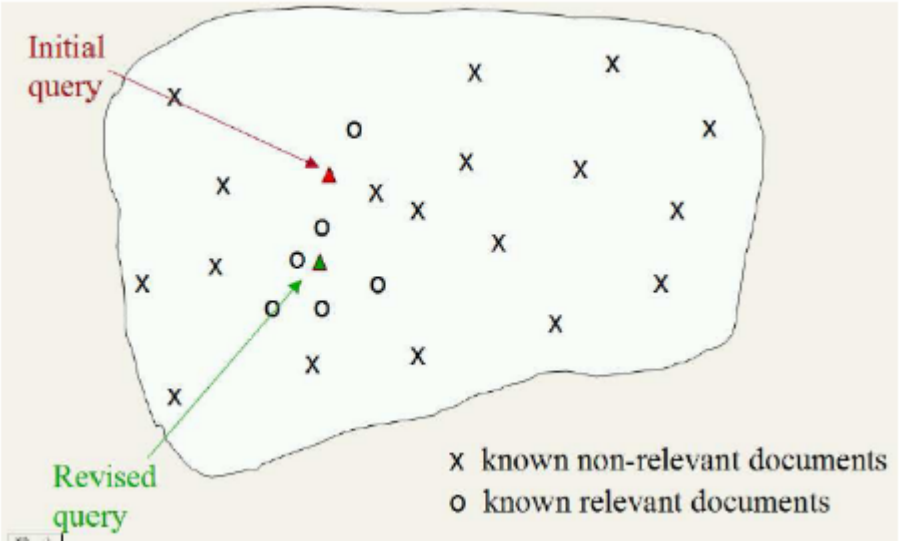
	MAP	R-Precision
No feedback	0.1591	0.2022
With feedback	0.1806 (+13.5%)	0.2222 (+9.9%)

Blind relevance feedback doesn't always help!



How to use Relevance Feedback?

- Assume that there is an optimal query
  - relevance feedback helps to bring user's query closer to the optimal one



- How?
  - Term reweighting:
    - boost weights of terms from relevant documents
  - Query expansion:
    - Add terms from relevant documents to the query

Relevance Feedback in Vector Space Model

- Rocchio Algorithm $\vec{q}_m = \alpha\vec{q}_0 + \beta\frac{1}{|D_r|}\sum_{\vec{d}_j \in D_r}\vec{d}_j - \gamma\frac{1}{|D_{nr}|}\sum_{\vec{d}_j \in D_{nr}}\vec{d}_j$
  - Often alpha = 1, Beta = 0.75, Gamma = 0.15
- Ide modifications
  - Ide: Beta and Gamma are 1, no normalization on Dr and Dnr

$$\vec{q}_m = \alpha\,\vec{q} + \beta\sum_{\forall\vec{d}_j \in D_r}\vec{d}_j - \gamma\sum_{\forall\vec{d}_j \in D_n}\vec{d}_j$$

  - Ide dec-hi: Beta and Gamma are 1, no normalization on Dr and Dnr, negative result only consider the highest ranked non-relevant doc

$$\vec{q}_m = \alpha\,\vec{q} + \beta\sum_{\forall\vec{d}_j \in D_r}\vec{d}_j - \gamma\ max_{non\text{-}relevant}(\vec{d}_j)$$

    - Ide dec-hi is the most effective when there are a few relevant docs

Rocchio in Example

$$\text{query vector} = \alpha \cdot \text{original query vector} + \beta \cdot \text{positive feedback vector} - \gamma \cdot \text{negative feedback vector}$$

Typically, $\gamma < \beta$

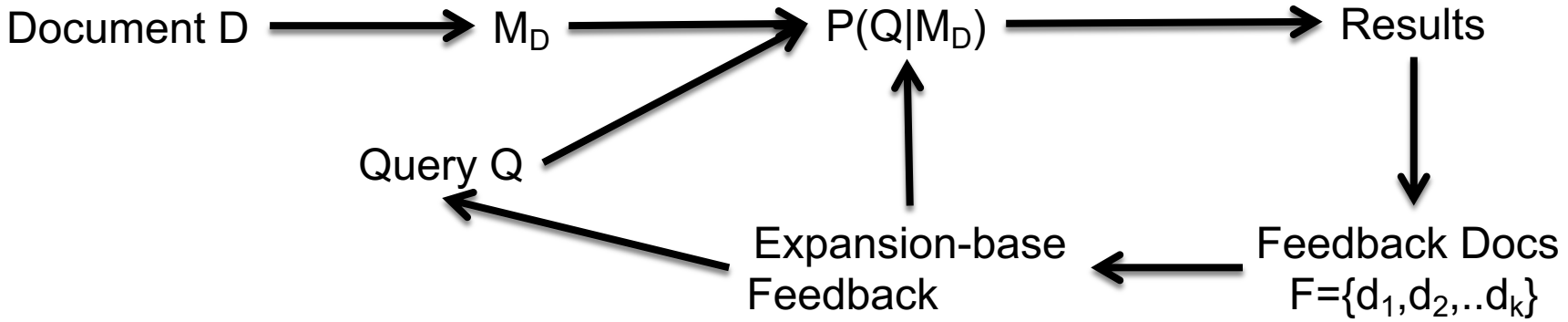
Original query	0	4	0	8	0	0	$\alpha = 1.0$	0	4	0	8	0	0
Positive Feedback	8	4	8	0	0	2	$\beta = 0.5$	4	2	4	0	0	1
Negative feedback	0	0	4	4	0	1	$\gamma = 0.25$	0	0	1	1	0	.25
New query								4	6	3	7	0	.75

(+)

(-)

Relevance Feedback in Language Models

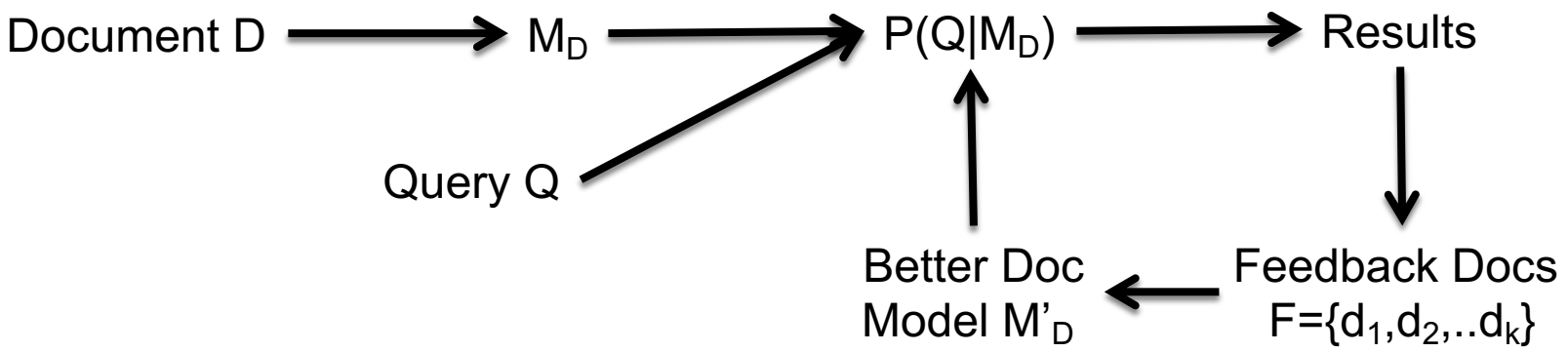
- Expansion-based Feedback in Query likelihood LMs



- Select new query terms from the feedback documents
  - Such as using TF-IDF or BM25 to select top weight terms
  - So the new terms are $\{nq_1, nq_2, \ldots, nq_n\}$
- Apply new query terms into new query
  - Combine with original query $Q' = \{q_1, q_2, .. q_m, nq_1, nq_2, \ldots, nq_n\}$, or
  - Simply viewed as the new query $Q' = \{nq_1, nq_2, \ldots, nq_n\}$

Relevance Feedback in Language Models

- Model-Interpolation Feedback in Query likelihood LMs



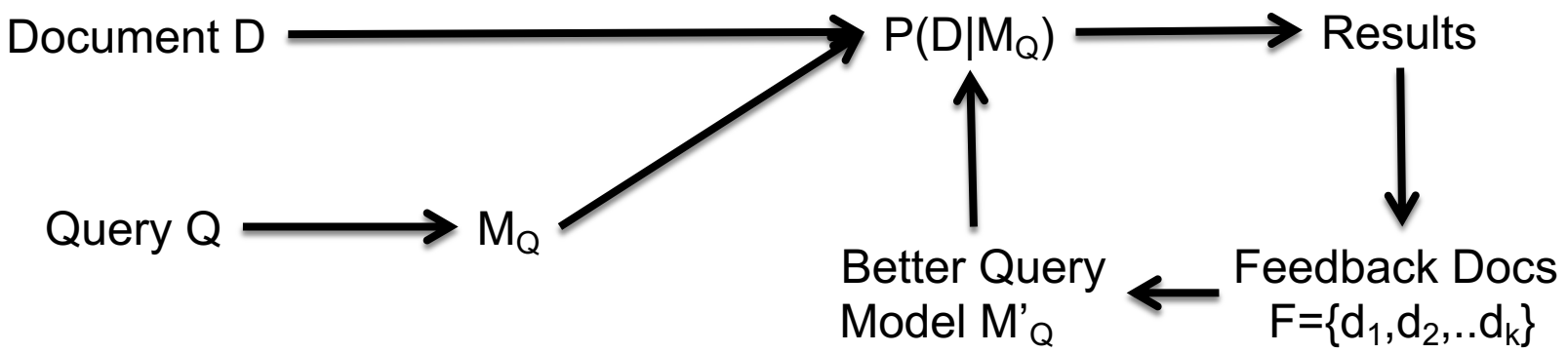
- Maybe hard to generate a query model, but can interpolate a better document model

$$P(Q|M'_D)=\alpha P(Q|M_D)+(1-\alpha)P(Q|F)$$

- We still can use JM smoothing or Dirochlet Prior smoothing for $P(Q|M_D)$

Relevance Feedback in Language Models

- Model-Interpolation Feedback in Document likelihood LMs



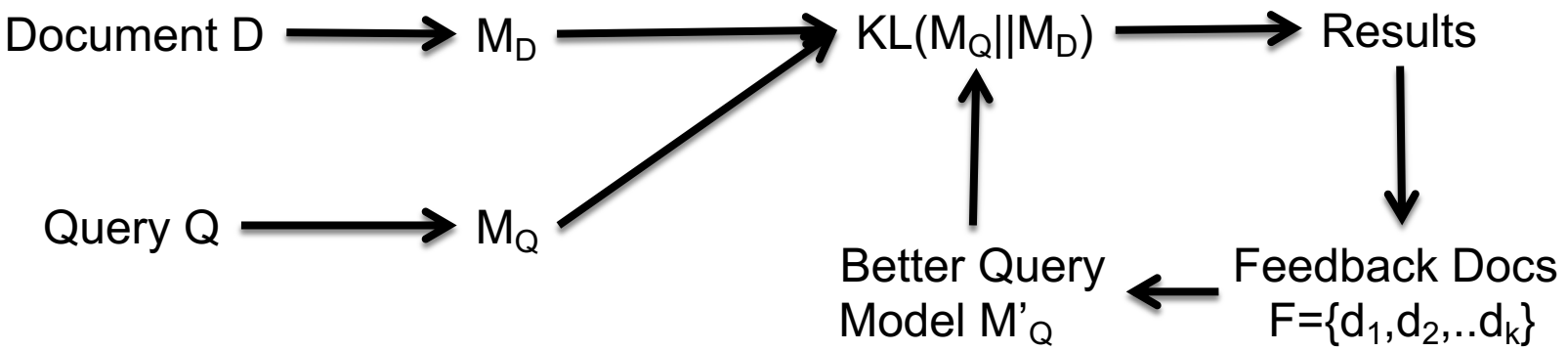
- Based on the feedback documents, we can estimate a better query model through interpolation

$$P(D|M'_Q)=\alpha P(D|M_Q)+(1-\alpha)P(D|F)$$

- We still can use JM smoothing or Dirochlet Prior smoothing for $P(D|M_Q)$

Relevance Feedback in Language Models

- Model-Interpolation Feedback in Model Comparison LMs



- Based on the feedback documents, we can estimate a better query model through interpolation

$$M'_Q=\alpha M_Q+(1-\alpha)M_F$$

- We still can use JM smoothing or Dirochlet Prior smoothing for both M_Q, and sometimes for M_F

What is Interactive IR

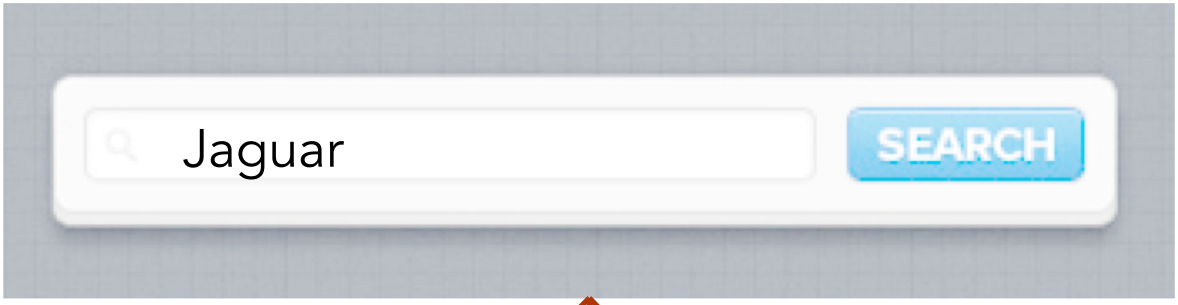
A System Oriented View of IR

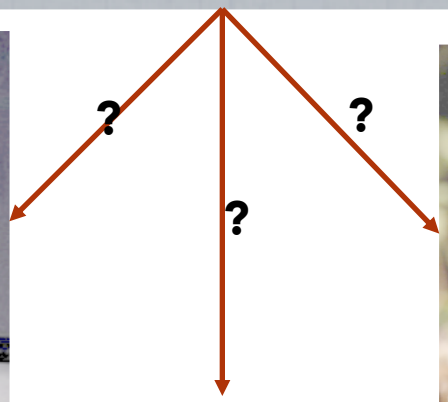
Query

Search Engine

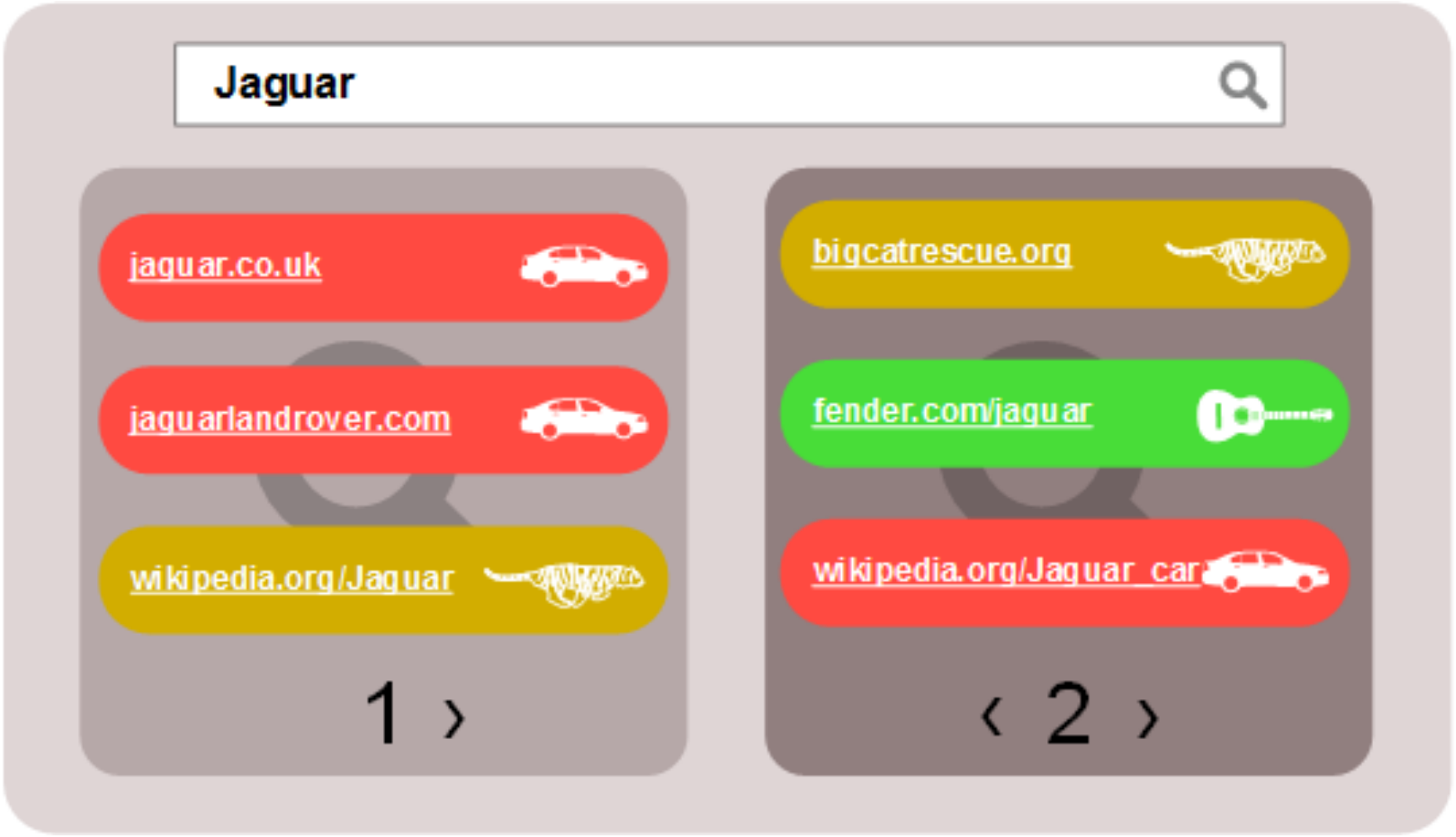
Ranked List

Scenario

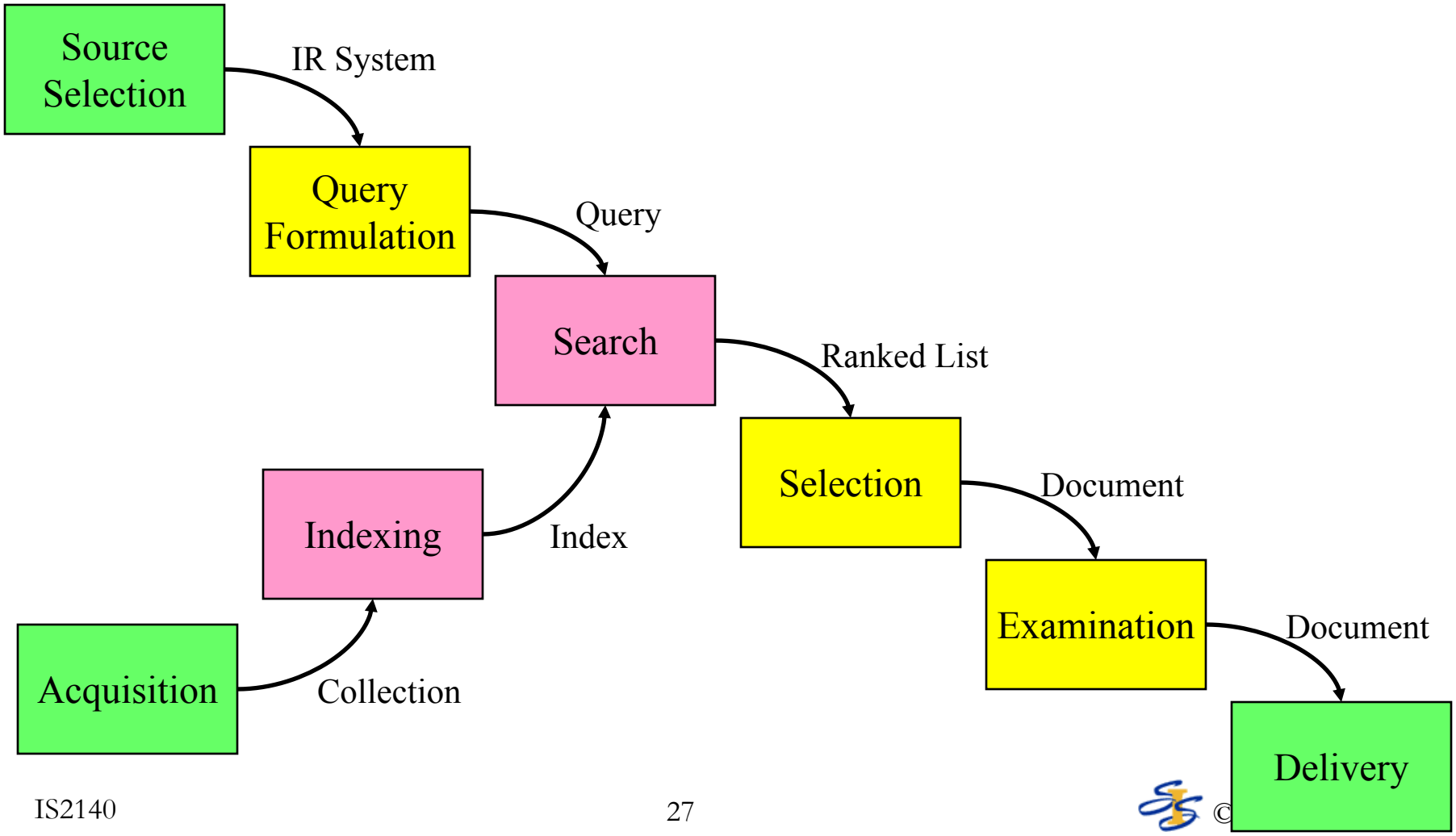




Example



Supporting the Search Process



Interactive IR Systems

- "In interactive IR, users and information retrieval systems are the two partners. Users interact with information retrieval systems via *interfaces of these systems*."

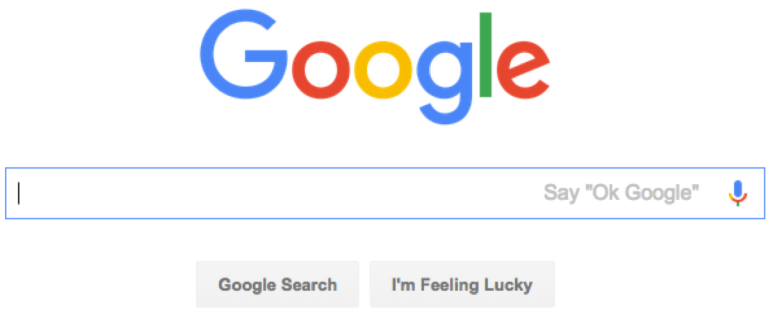
Xie, H. (2007). "Shifts in information-seeking strategies in information retrieval in the digital age: Planned-situational model" *Information Research*, 12(4) paper colis22. [Available at http://InformationR.net/ir/12-4/colis/colis22.html]

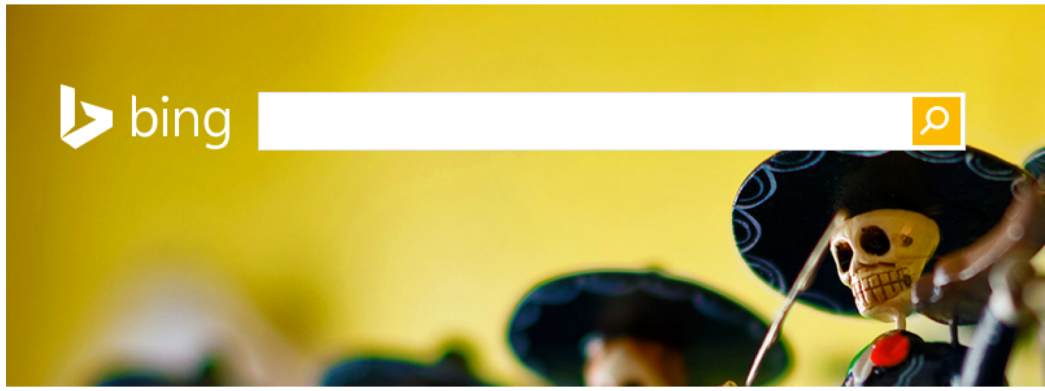
Design Interactive IR

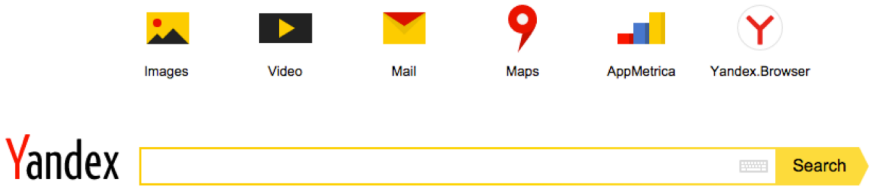
General Design Principles

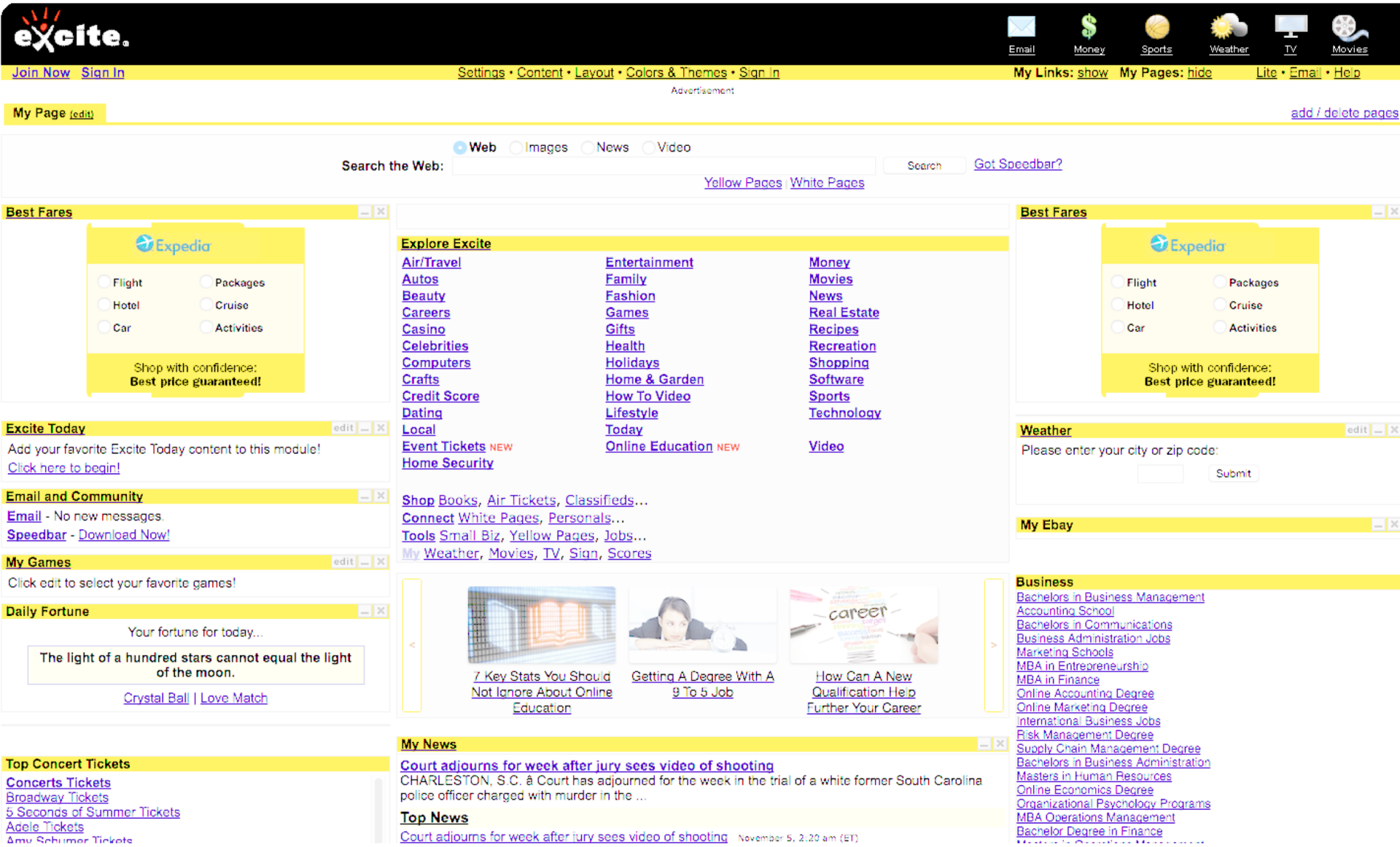
- Pay attention to **usability**: how easy it is to use (5 components)
  - *Learnability:* How easy is it for users to accomplish basic tasks the first time they encounter the interface?
  - *Efficiency:* How quickly can users accomplish their tasks after they learn how to use the interface?
  - *Memorability:* After a period of non-use, how long does it take users to reestablish proficiency?
  - *Errors:* How many errors do users make, how severe are these errors, and how easy is it for users to recover from these errors?
  - *Satisfaction:* How pleasant or satisfying is it to use the interface?

Modern Search Interface









Screenshot on Nov.6, 2016

Screenshot on Nov.6, 2016

General Design Principles

- Which one do you prefer?
- Why?

- Reasons from Hearst's "Search User Interface" book
  - Users in search are usually engaged in some larger task, and do not want their flow of thought interrupted by an intrusive interface.
  - Search is a mentally intensive task. It is not possible to read and to think about something else at the same time. Thus, the fewer distractions while reading, the more usable the interface.
  - The interface design must be understandable and appealing to a wide variety of users of all ages, cultures and backgrounds, applied to an enormous variety of information needs. **Everyone can use it!**

General Design Principles

- design desiderata for search user interfaces
  - Offer informative feedback.
  - Support user control.
  - Reduce short-term memory load.
  - Provide shortcuts for skilled users.
  - Reduce errors; offer simple error handling.
  - Strive for consistency.
  - Permit easy reversal of actions.
  - Design for closure: user has a sense when the search is complete

http://www.dlib.org/dlib/january97/retrieval/01shneiderman.html

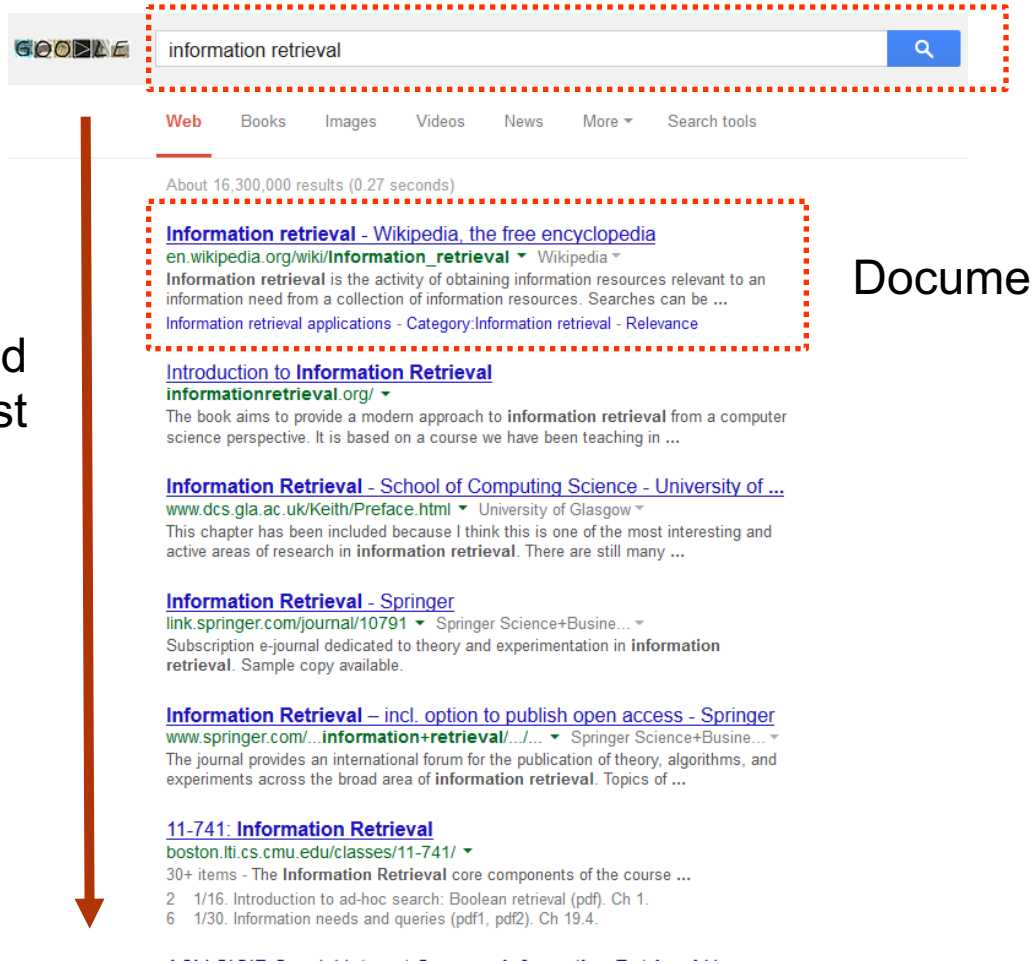
General Design Principles

- Offer efficient and informative feedback
  - Show search results immediately
  - Show informative document surrogates; highlight query terms
  - Allow sorting of results by various criteria
  - Show query terms suggestions
  - Provide simple and meaningful history mechanism
  - Integrated search and navigation

- More on this topic can be found at http://searchuserinterfaces.com/book/sui_ch1_design.html

Interactive IR System

- Typically, the Search Engine Result Pages (SERP)

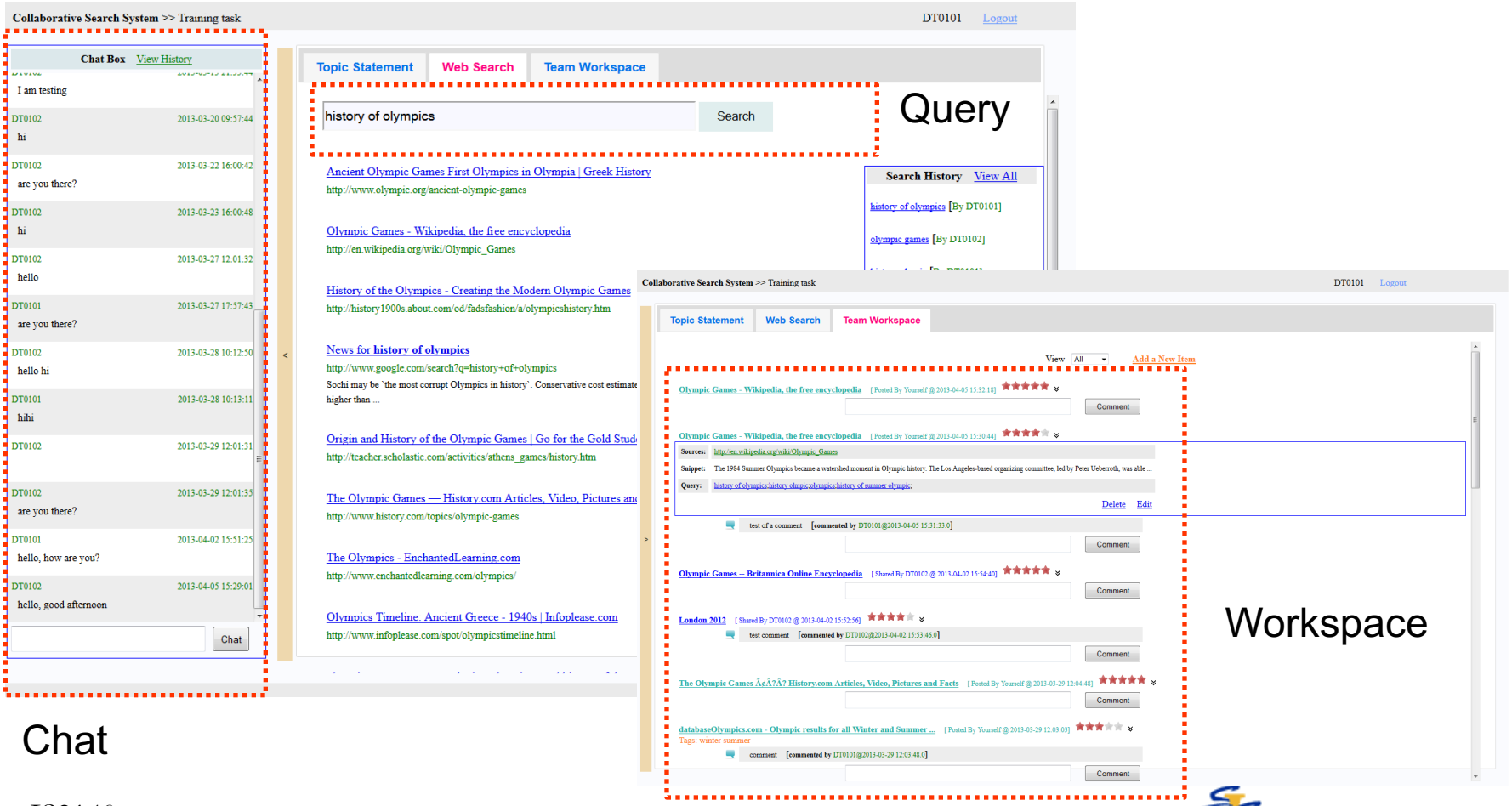


Interactive IR System

- IIR system may be sophisticated in complex search scenarios

Interactive IR System

- IIR system may be sophisticated in complex search scenarios



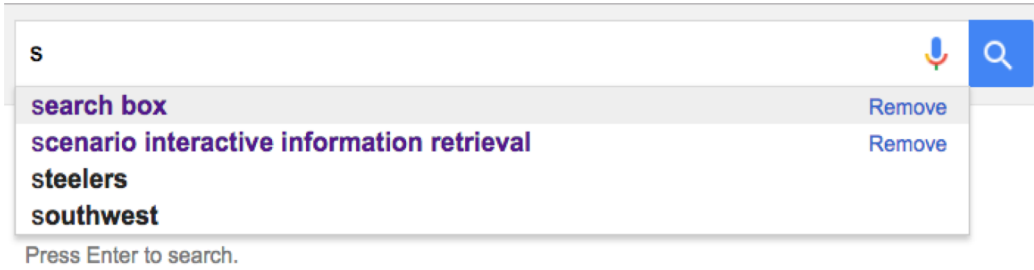
Query Formulation and Reformulation

Query Formulation

- User's goals
  - Identify the right query for the current need
    - conscious/formalized need => compromised need
- How can the user achieve this goal?
  - Infer the right query terms
  - Infer the right composition of terms
- More recently …
  - Spoken queries
  - Queries from Scanning / taking pictures
  - Search by drawing
  - etc.

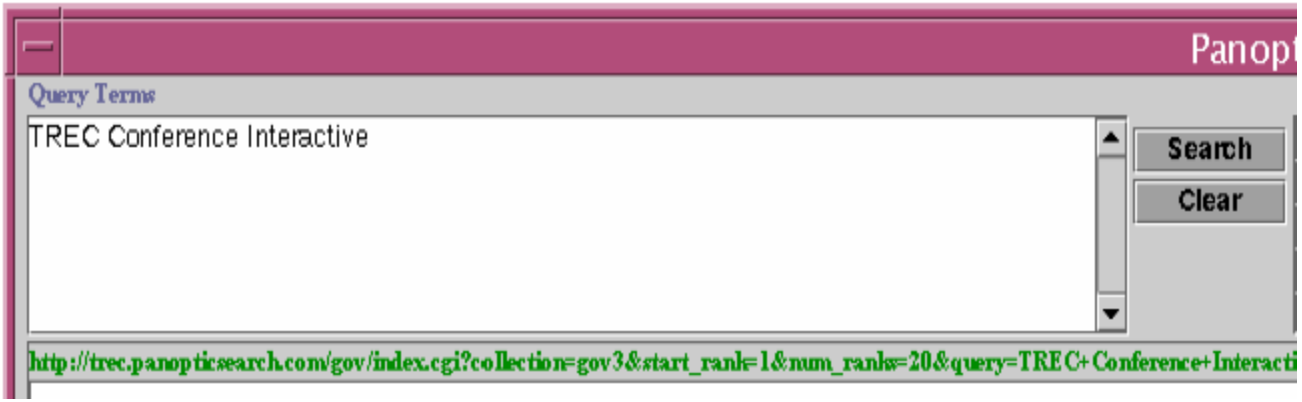
Query Formulation -II

- What IR system can do?
  - Ask more from the user
    - Encourage long/complex queries
      - Provide a large text entry area
      - Use forms filling or direct manipulation
    - Obtain contextual information from users
      - Location
      - Date and time
      - Devices…
  - Infer from relevant items
    - Infer from previous queries, term auto suggestions
      - http://www.google.com/
    - Infer from previous retrieved documents

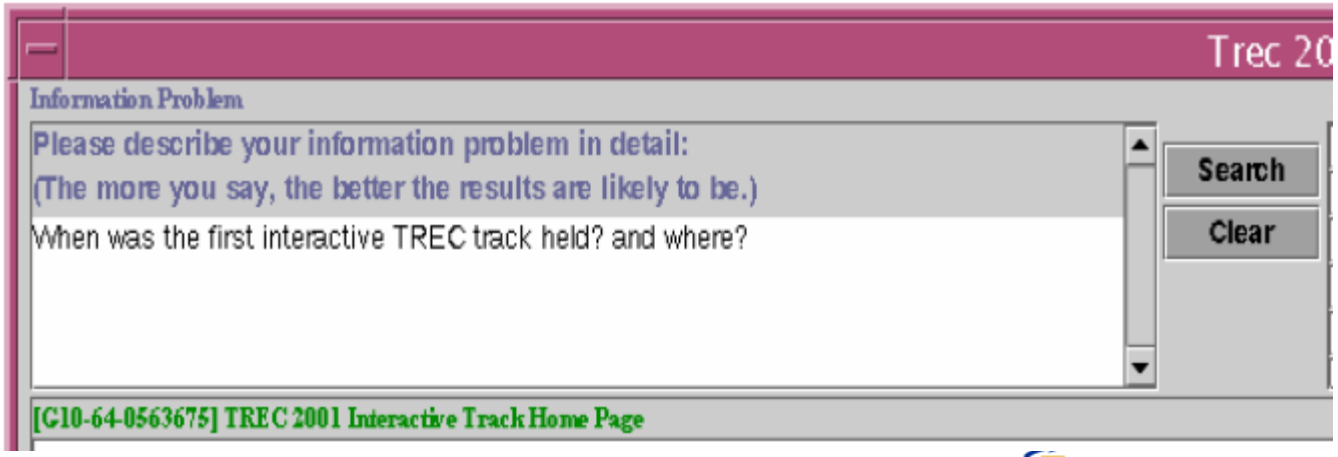


leading longer queries

- 4.19 words on average in the top versus 6.02 words



A search interface which asks searchers to describe their information problems at length will lead to longer queries than one which asks searchers to simply input a query as a list of words or phrases



Belkin et al., 2003

leading longer queries

Figure 1. An empty query box has a pink halo.

Figure 2. As the person starts to type, red hue starts to fade.

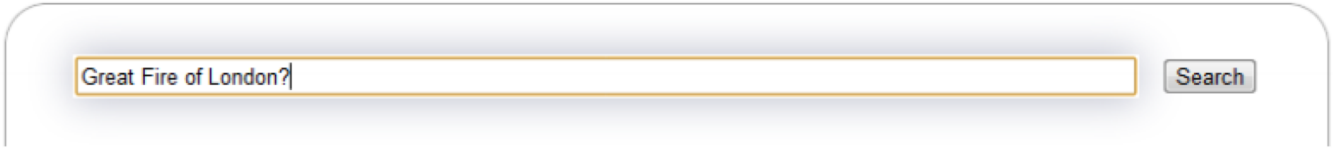


Figure 3. As the query gets longer, the halo becomes progressively bluer.

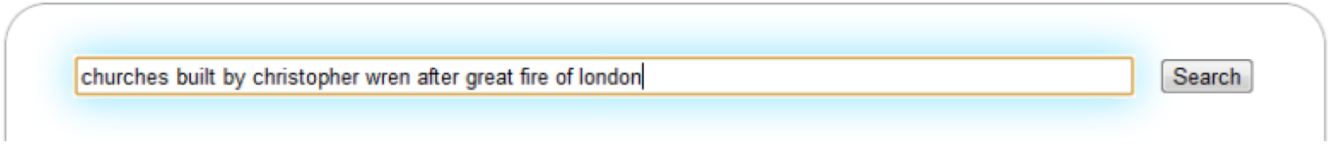
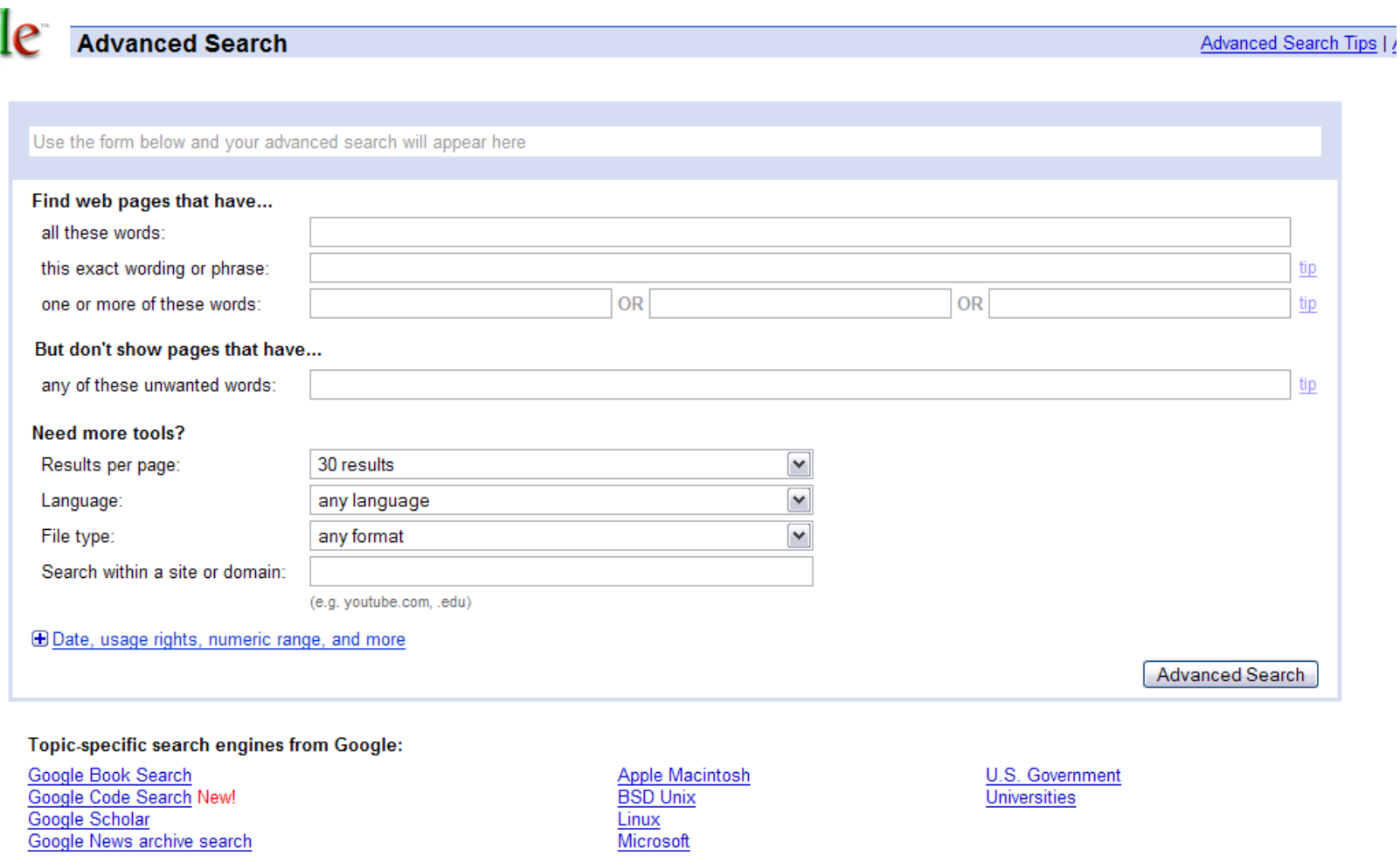


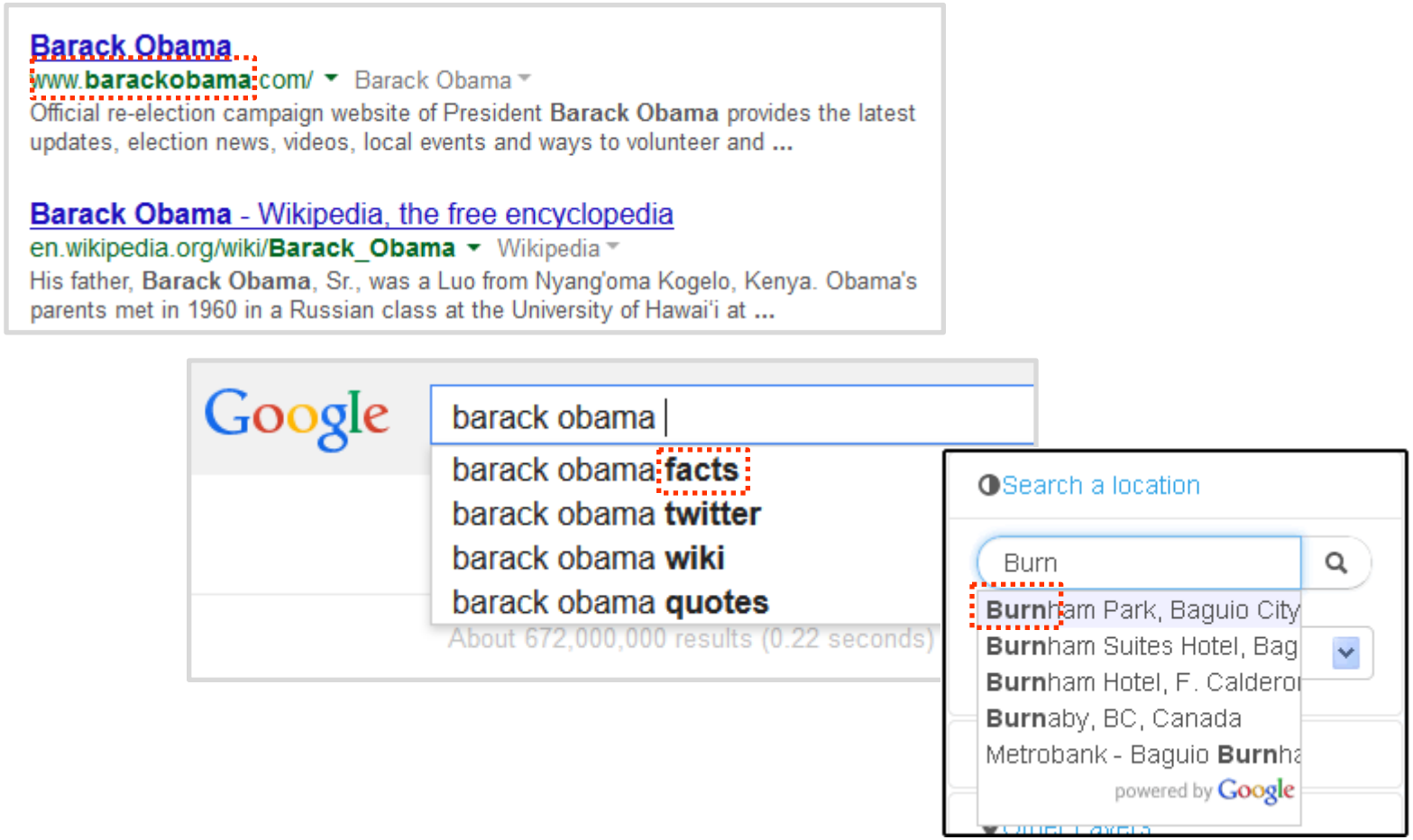
Figure 4. Long queries are displayed with a blue halo.

Agapie, E., Golovchinsky, G., & Qvarfordt, P. (2013, April). Leading people to longer queries. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 3019-3022). ACM.

Form-Based Query Formulation (Google)



Highlight suggested query terms

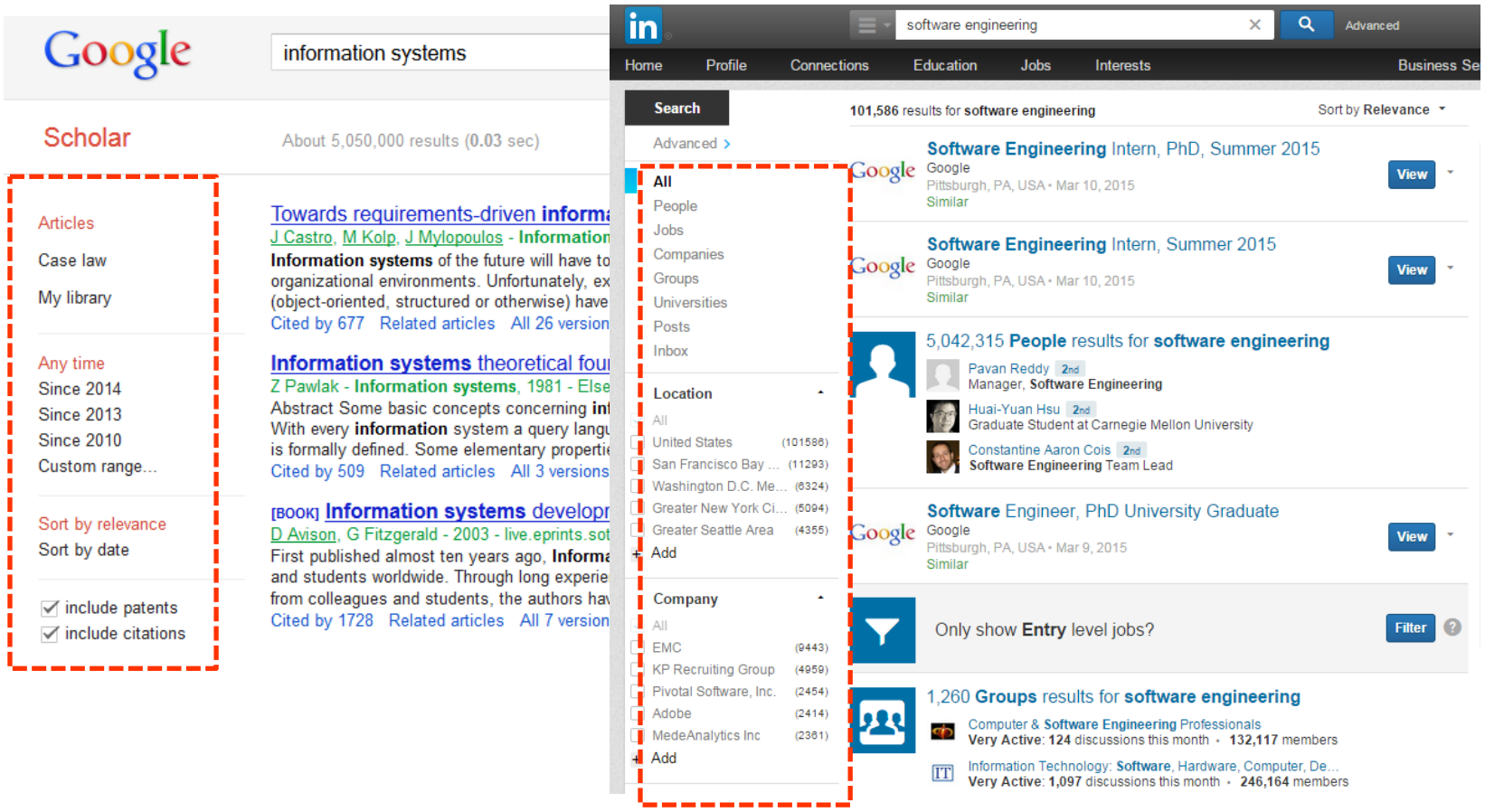


Query Reformulation

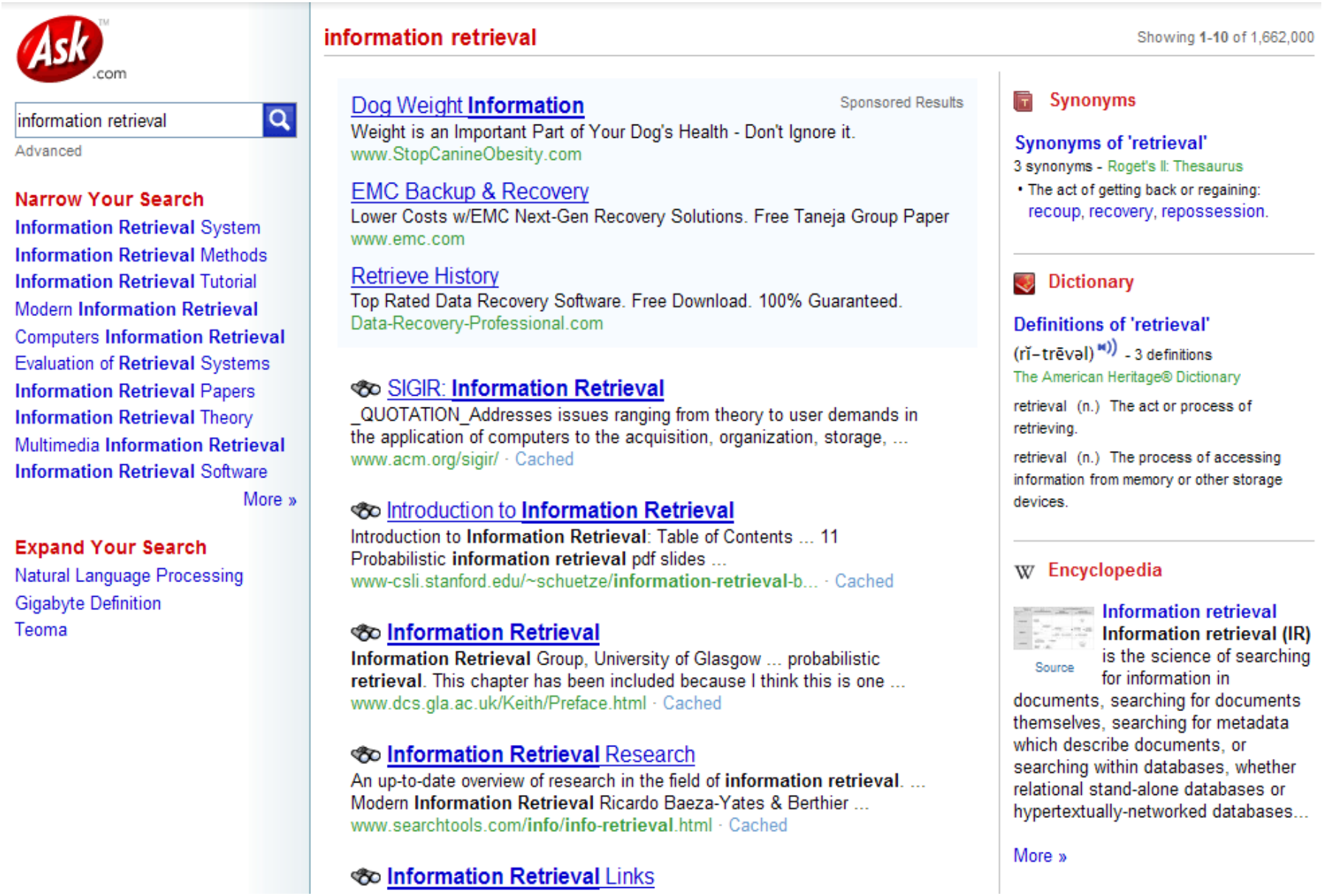
- Historical queries
- Related queries

Query Reformulation

- Providing facets. E.g., Google Scholar, LinkedIn

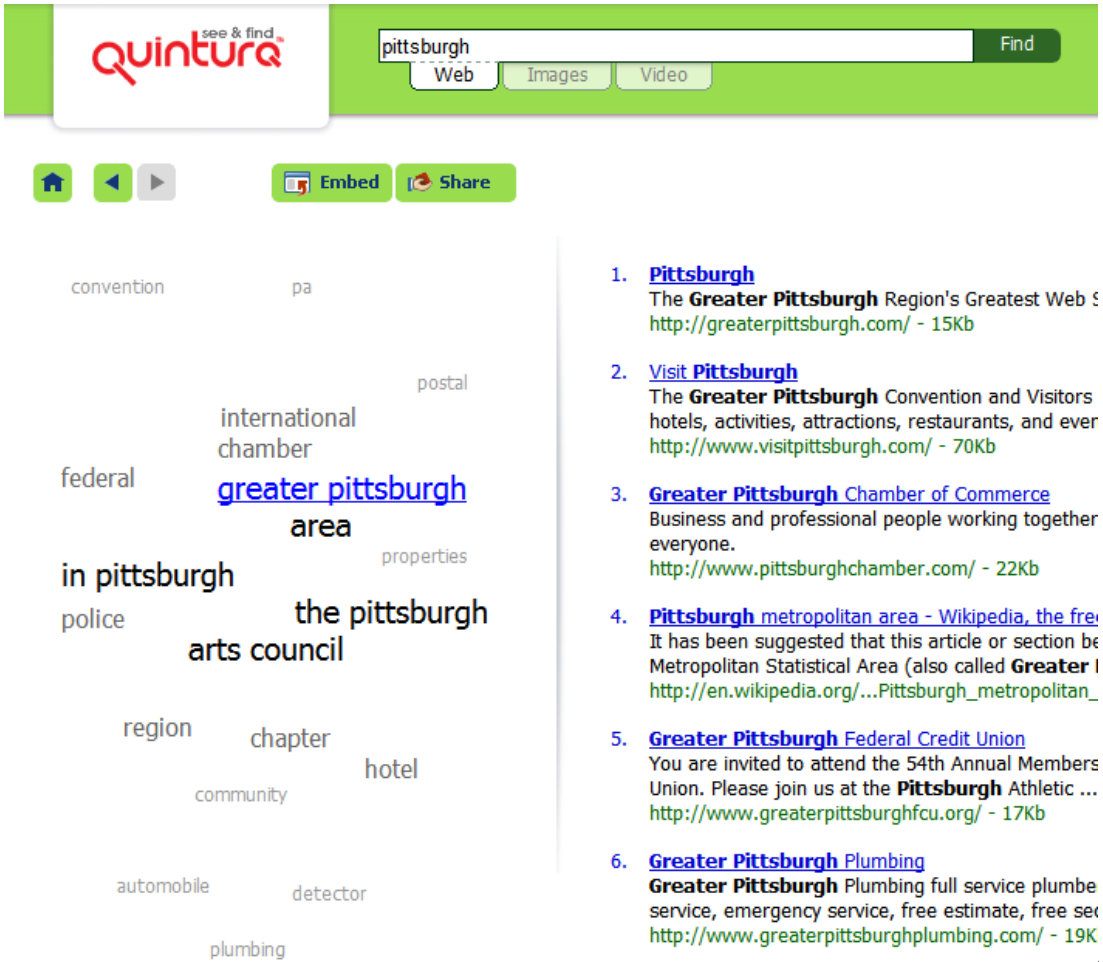


Ask's Query Refine Suggestions



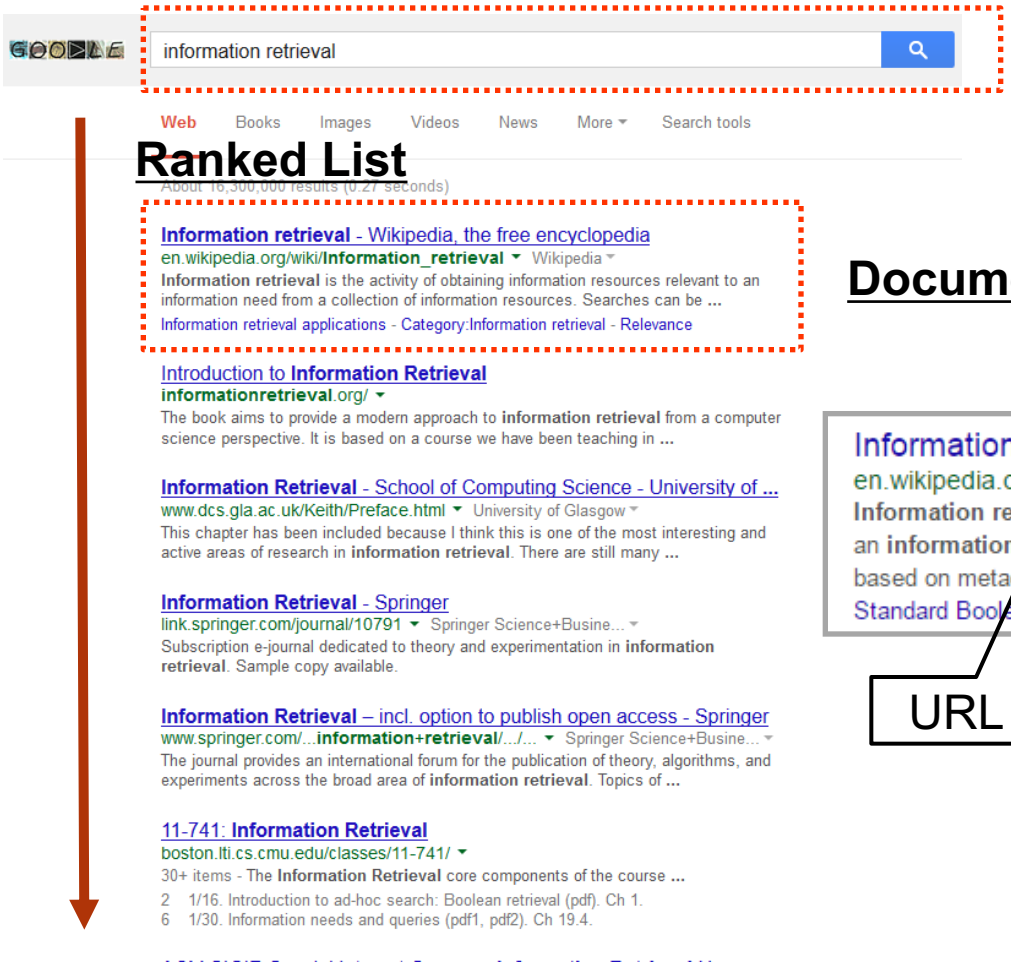
Visualizing Related Terms

- http://www.quintura.com/

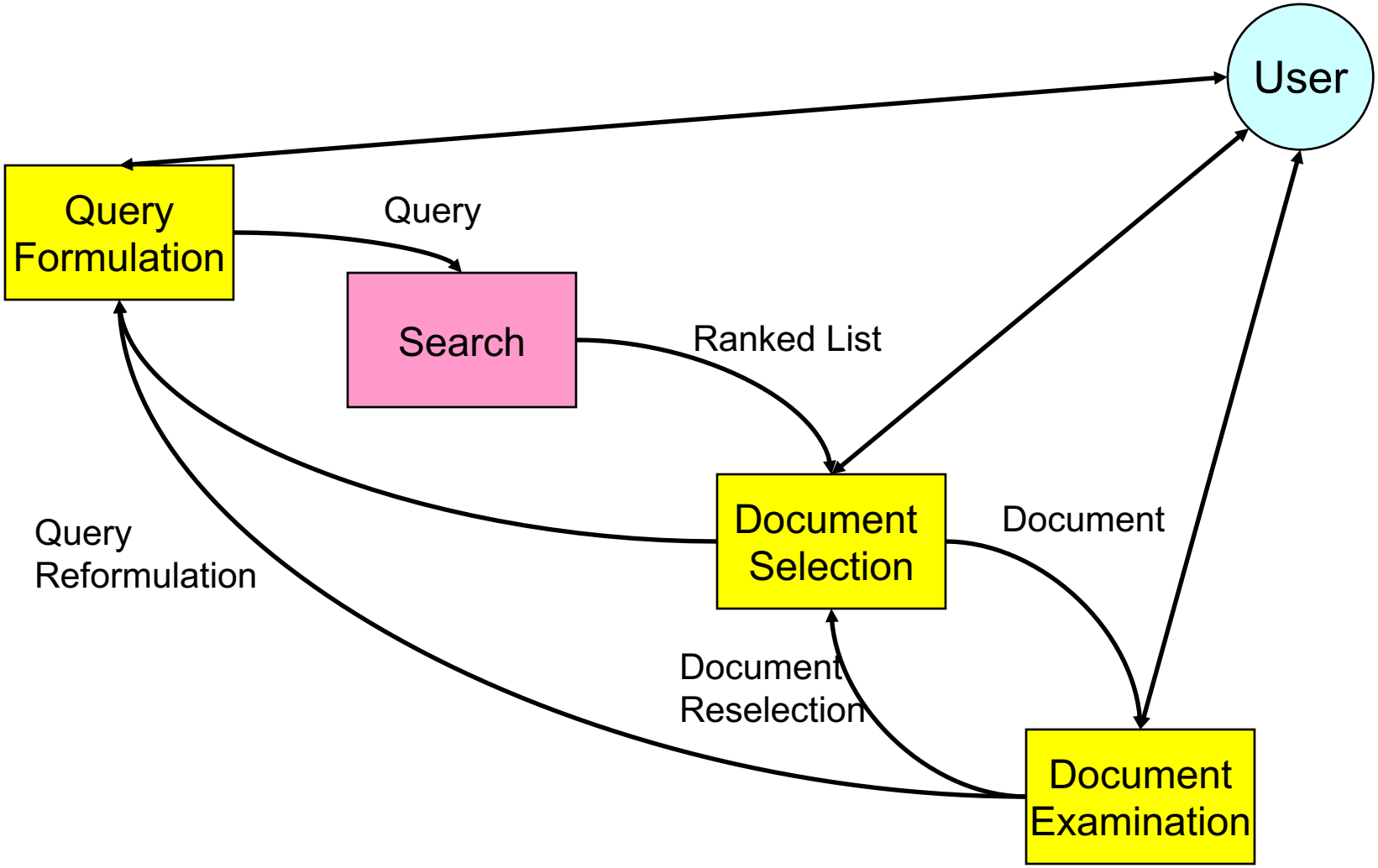


Search Result Presentation

Interactive IR System



Search Results Presentation



Post-Search Analysis

- Depends on the types of information needs
  - Simple cases: identification of the relevant items
  - Complicated cases: exploration, learning and investigation
- Post-search analysis types: looking for information to explore
  - Trends
  - Comparisons
  - Aggregation and Scaling
  - Identifying a Critical Subset
  - Assessing
  - Interpreting
  - others: cross-reference, summarize, find evocative visualizations …

Search Results Presentation

- User's goals:
  - Identify docs for use => completing the search tasks
  - Identify new query terms/combinations => continue the search
    - Useful terms for future queries
- System goals:
  - minimize time/effort for deciding which docs to examine
  - Assist user to identify relevant documents
  - Assist user to identify potential useful terms
    - for clarifying the right information need
    - for generating better queries

Solutions

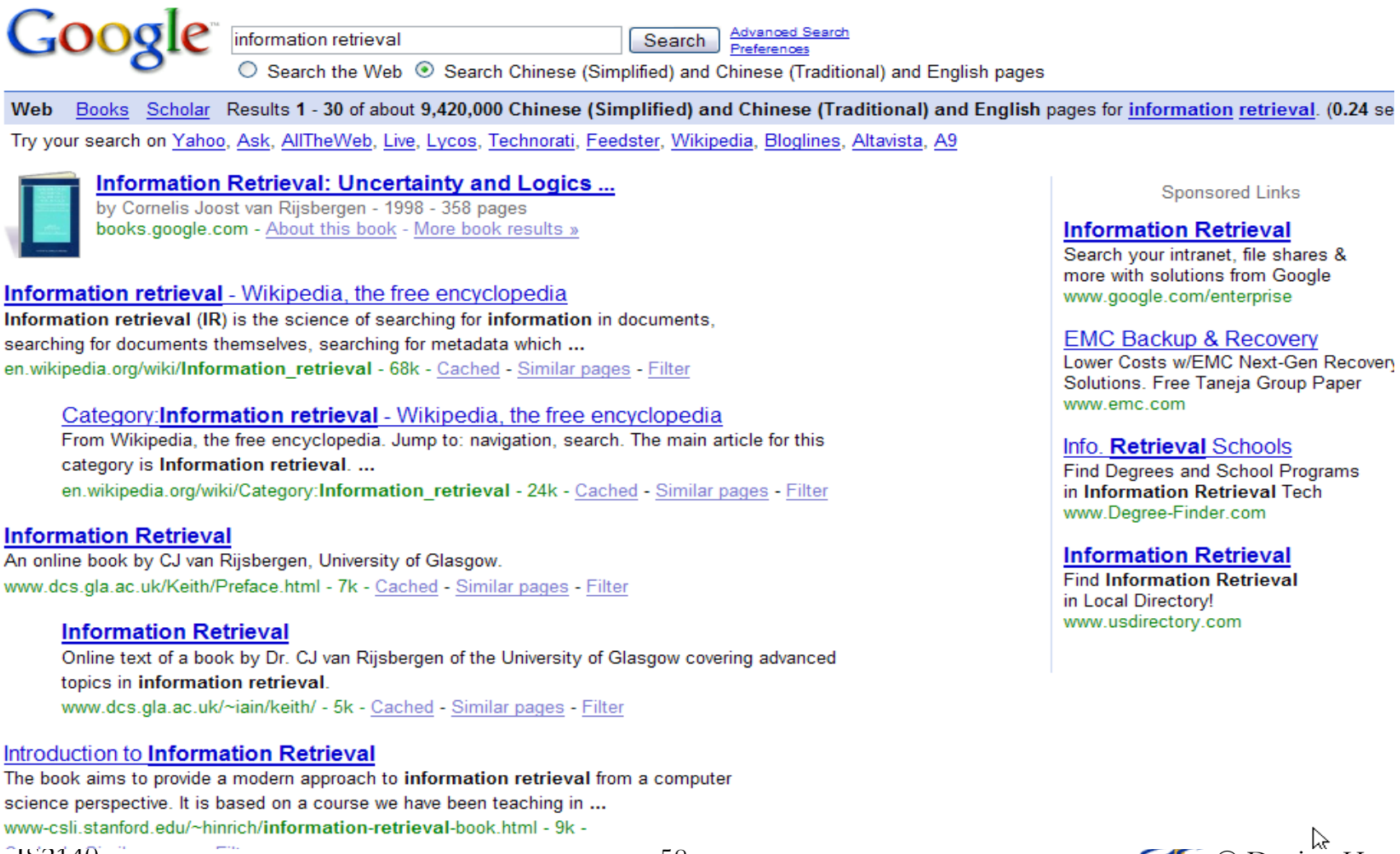
- Search Interfaces should
  - Show the roles of the query terms in the retrieved documents
  - give hints about the roles certain terms play in the collection
  - give hints about what will happen if various terms are combined
  - show explicitly why documents are retrieved in response to the query
  - summarize compactly the subset of interest
- Technologies
  - Summarization: generate document surrogates
  - Presentation: Textual vs graphical, One dimensional vs two dimensional vs three dimensional

Document Surrogate

- Design of document surrogate influences user clicks
  - Where possible, all the query terms should appear in the surrogate, reflecting their relationship to the corresponding Web page
  - When the query terms are present in the title, they need not appear in the summary
  - Length and complexity of URLs should be reduced, and URLs should be selected and displayed in a manner that emphasizes their relationship to the query.

Clarke, C. L., Agichtein, E., Dumais, S., & White, R. W. (2007). The influence of caption features on clickthrough patterns in web search. In *SIGIR 207:*135-142

Google's KWIC Document Surrogates



Document Surrogate

- Design of document surrogate influences user clicks
  - My own experience at **Baidu** (2009)

左宗棠鸡_百度百科

湘菜名菜，主料为鸡，为美国人认知中最著名的中国菜之一。以湖南名将左宗棠的名字命名，但其实与他无关。

菜品介绍 做法 营养价值 食用指南

baike.baidu.com/ 2013-12-26

左宗棠鸡_百度百科

湘菜名菜，主料为鸡，为美国人认知中最著名的中国菜之一。以湖南名将左宗棠的名字命名，但其实与他无关。

菜品介绍 做法 营养价值 食用指南

baike.baidu.com/ 2013-12-26

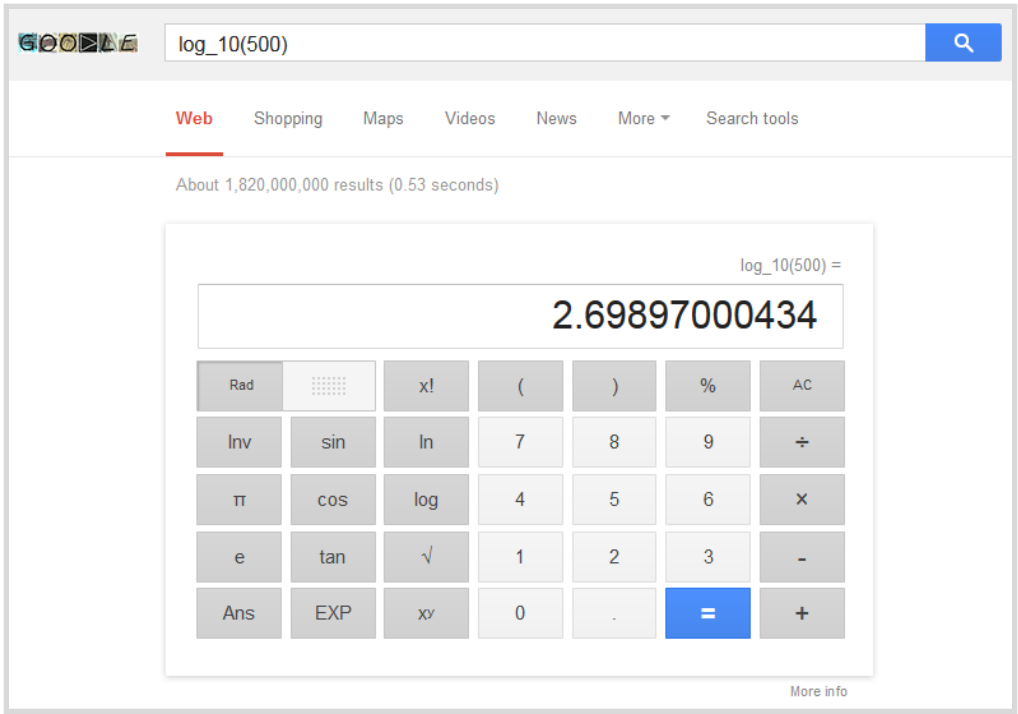
+10% clicks

Document Surrogate

- The end goal isn't necessary the document set

Pittsburgh Weather

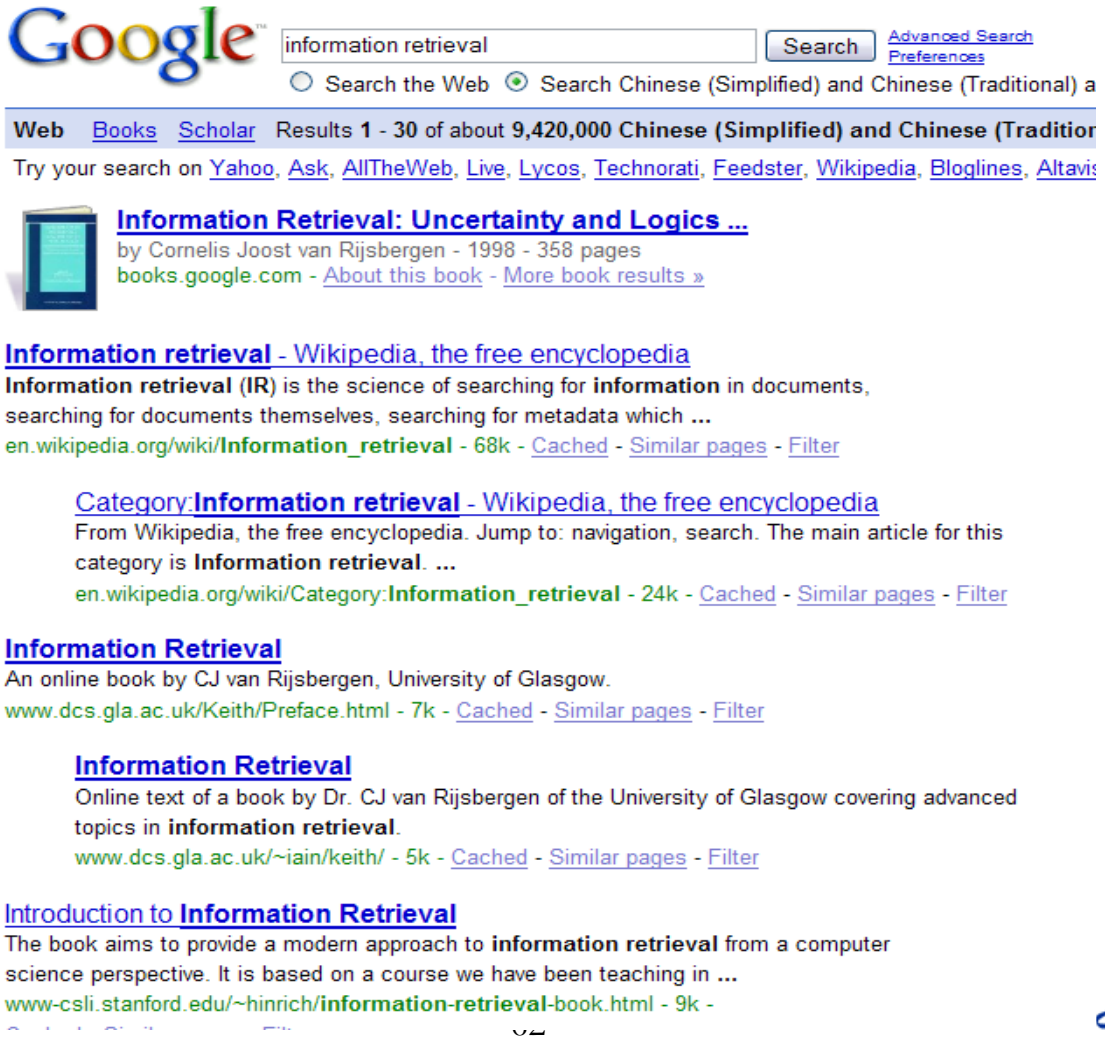
lg 500



Taxonomy for Result Presentation

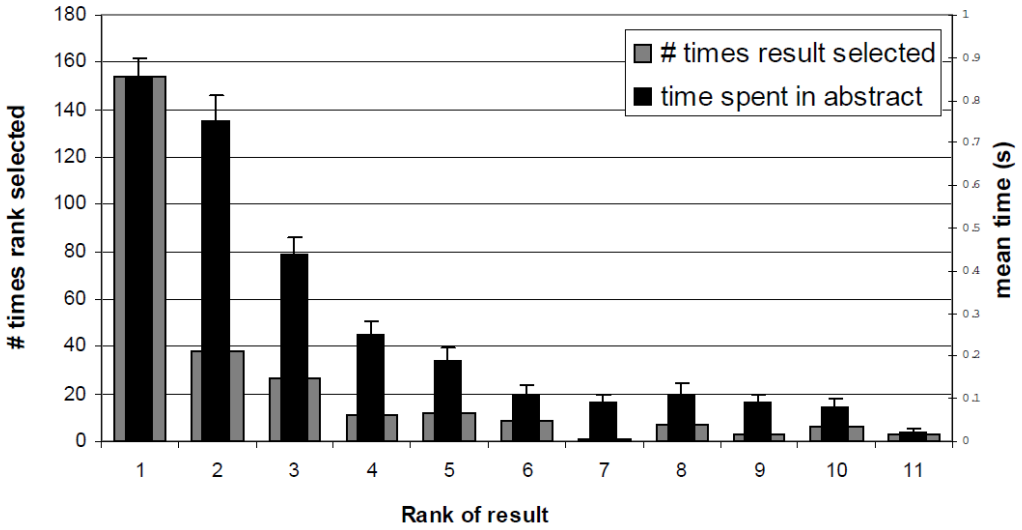
- One dimensional lists
  - Content: title, source, date, summary, ratings, …
  - Order: retrieval status value, date, alphabetic, …
  - Size: scrolling, specified number, RSV threshold
- Two dimensional displays
  - Construction: clustering, starfields, projection
  - Navigation: jump, pan, zoom
- Three dimensional displays
  - Contour maps, fishtank VR, immersive VR

Results Presented as a Ranked list

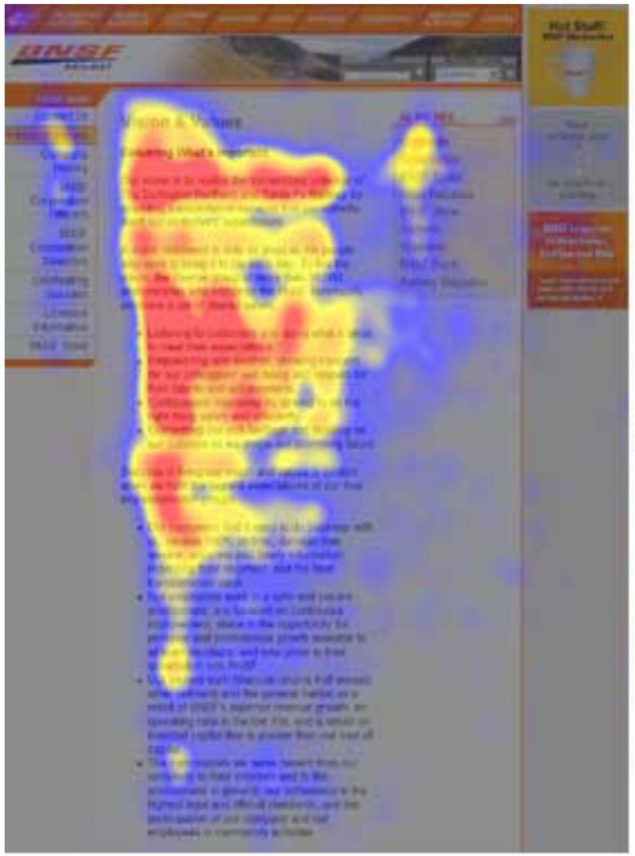


Ranked List

- Ranked Lists of search result representation biased on top results



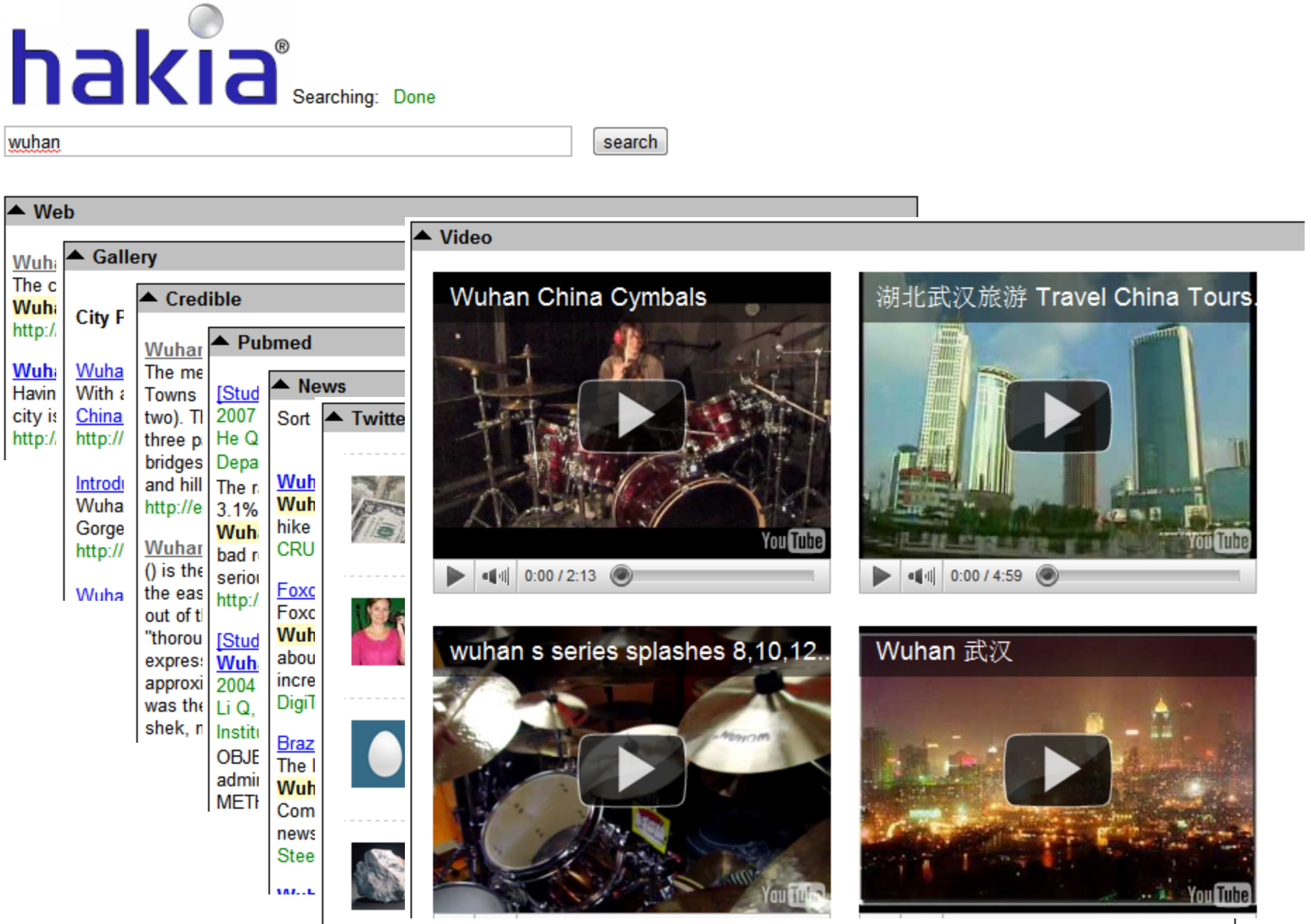
Laura A. Granka, Thorsten Joachims, and Geri Gay. 2004. Eye-tracking analysis of user behavior in WWW search. In SIGIR '04. ACM, New York, NY, USA, 478-479.



http://www.nngroup.com/articles/f-shaped-pattern-reading-web-content/

Blend Results and Media Types

- Web search is not just search for Web pages anymore
  - Information exist in many different sources and media types
  - Search engines increasingly automatically collect them and display together
    - Example: search "pittsburgh" in google, bing, yahoo,
    - Especially in www.hakai.com


hakia
Searching: Done
wuhan
search
Web
Gallery
Credible
Pubmed
News
Twitte
Video
Wuhan China Cymbals
0:00 / 2:13
湖北武汉旅游 Travel China Tours.
0:00 / 4:59
wuhan s series splashes 8,10,12..
Wuhan 武汉

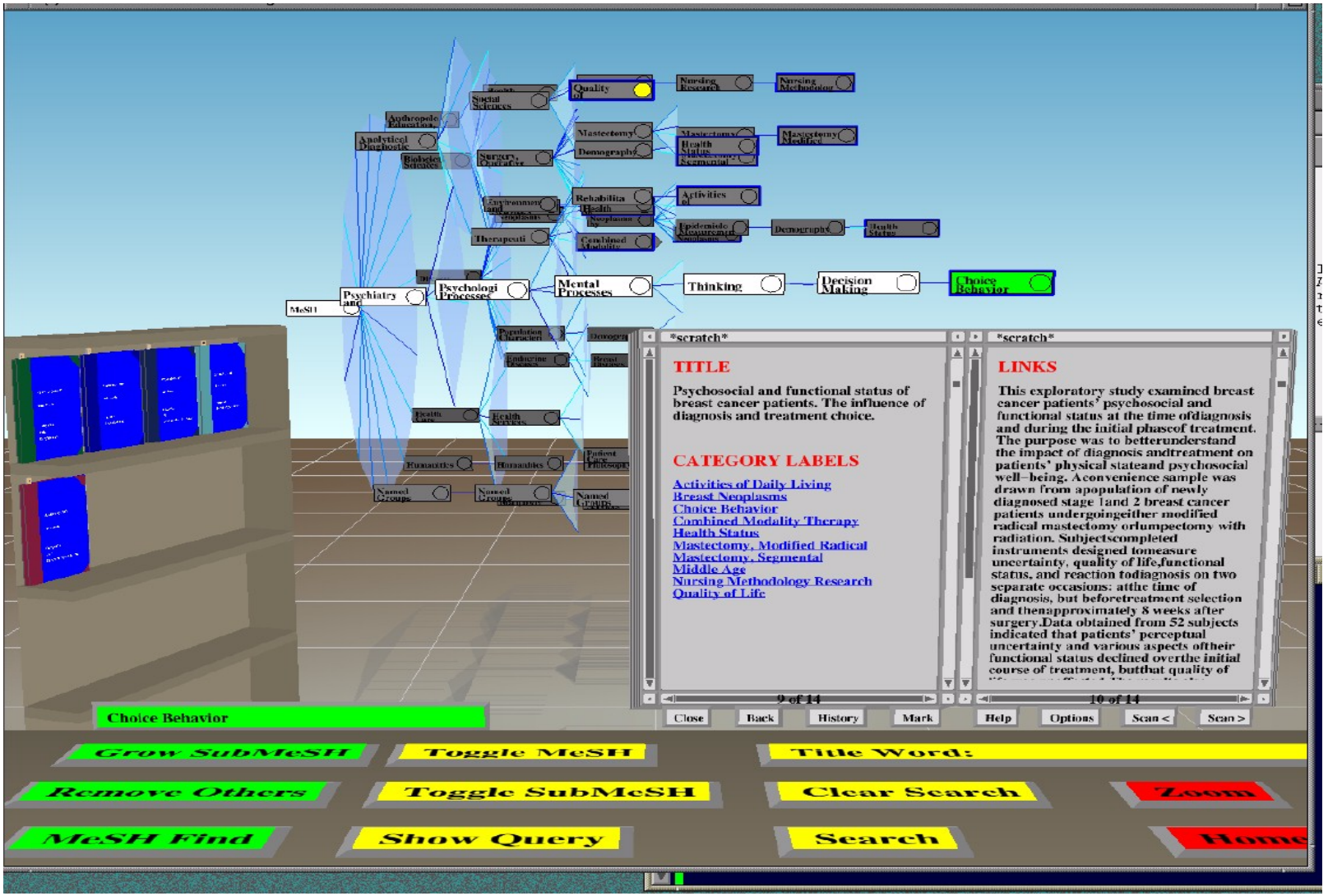
Grouping Search Results

- Categorizing search results
  - Key idea: utilizing existing categories to group documents into categories
  - Example: Cat-a-Cone
- Clustering search results
  - Based on inter-document similarity
    - Computed using the cosine measure, for example
  - Text; Vivisimo's clusty, scatter/gather
  - 1D: scatter/gather
  - 2D: Kartoo
  - 3D: ThemeView

Cat-a-Cone

- Key Ideas:
  - Integrate searching and browsing of very large category hierarchies with their associated text collections
  - Separate documents from category labels
    - allows the display of multiple categories per document
  - display of *multiple* selected categories simultaneously, complete with their hierarchical context
- No online demo, but with many detail discussion at http://people.ischool.berkeley.edu/~hearst/cac-overview.html

Cat-a-Cone Interface



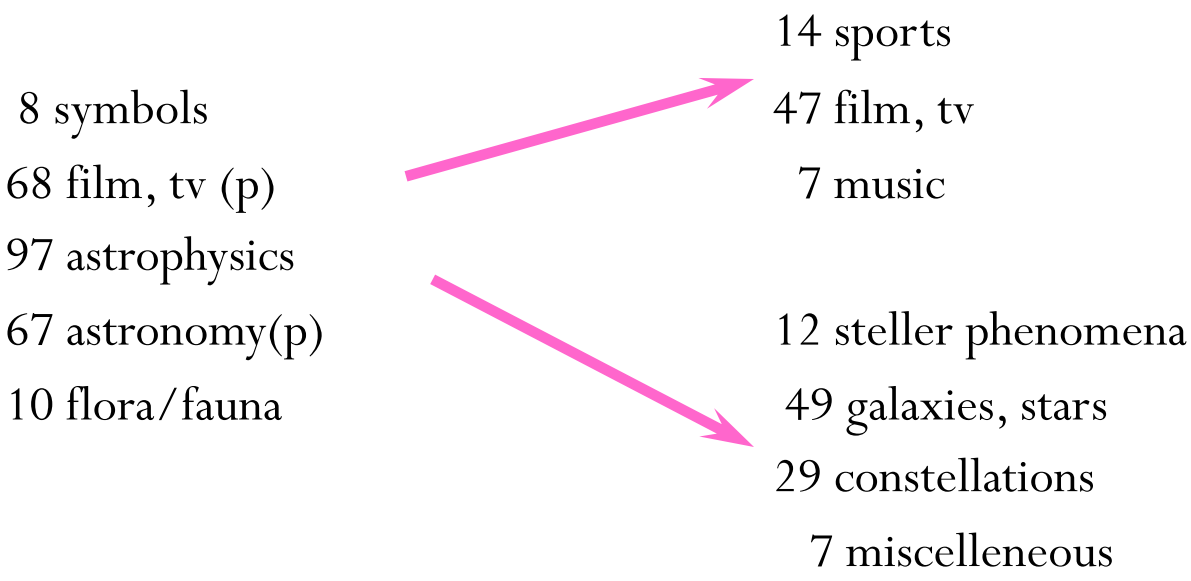
Scatter/Gather

Cutting, Pedersen, Tukey & Karger 92, 93, Hearst & Pedersen 95

- How it works
  - Cluster sets of documents into general "themes", just like a table of contents
  - Display the contents of the clusters by showing topical terms and typical titles
  - User chooses subsets of the clusters and re-clusters the documents within
  - Resulting new groups have different "themes"
- Originally used to give collection overview
- Evidence suggests more appropriate for displaying retrieval results in context

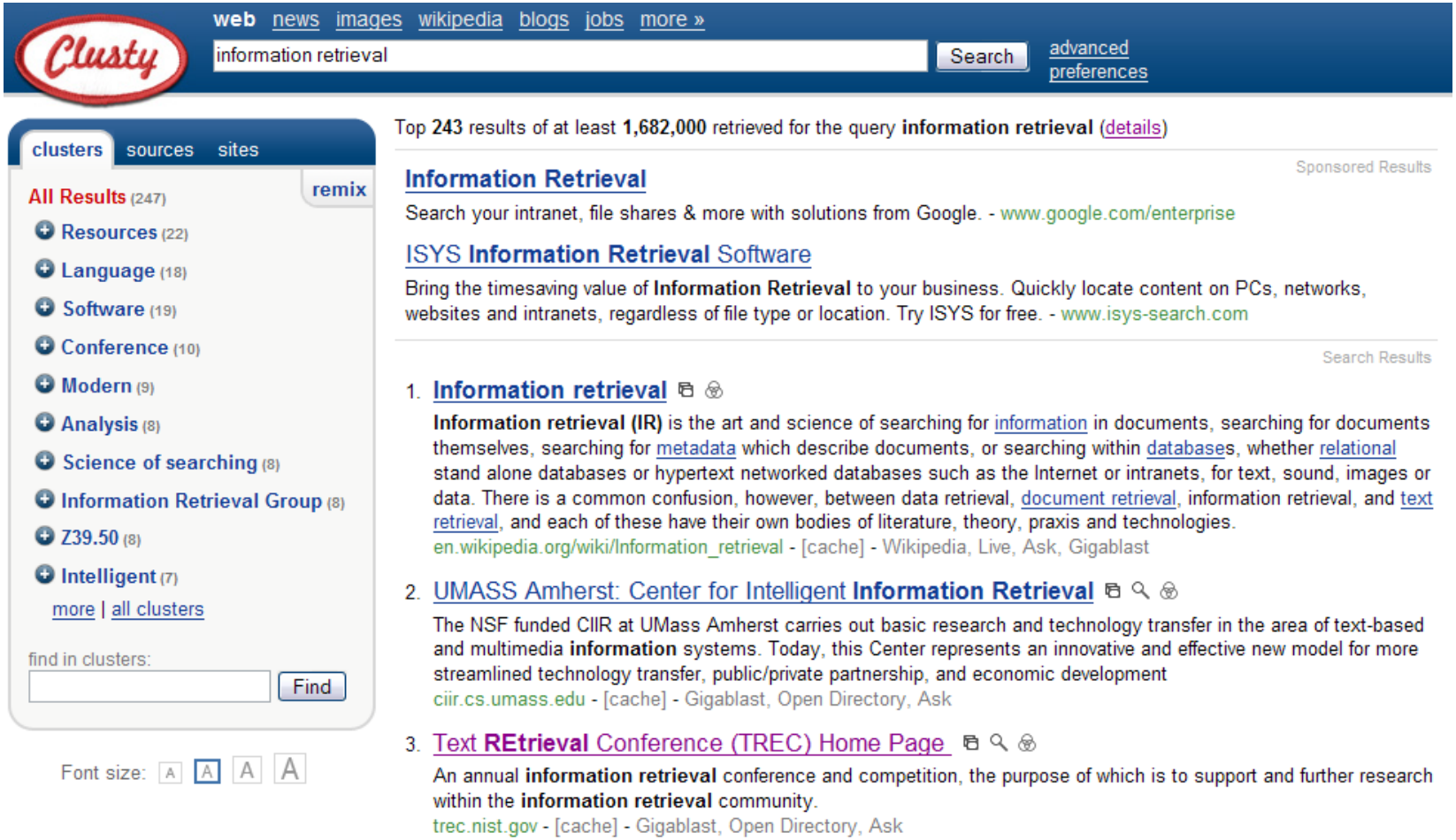
Example: query on “star”

Encyclopedia text



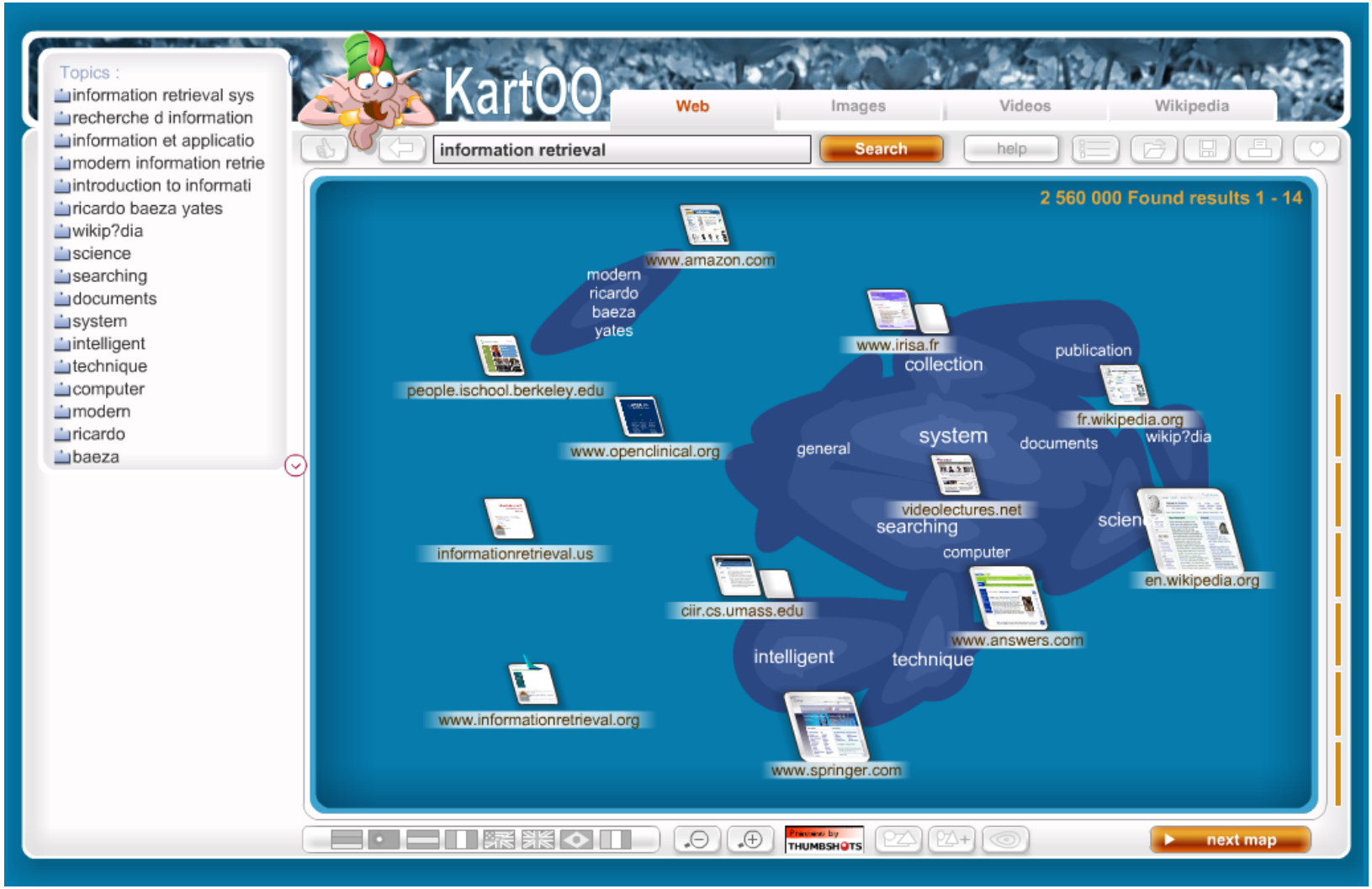
Clustering and re-clustering is entirely automated

Vivisimo's Clustering Results



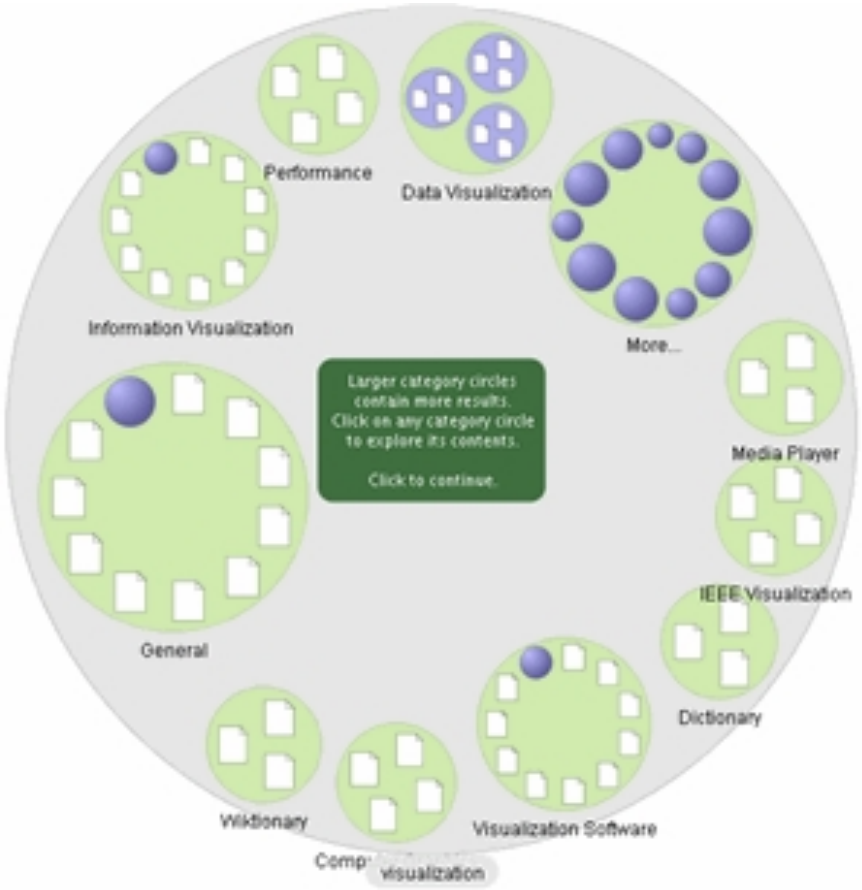
www.clusty.com

Kartoo's Cluster Visualization



Grokker's Clustering Visualization

- clusters its results and presents them in a unique circular map
- www.grokker.com no longer work now



Visualizing Named Entities in Results

NameSieve pittsburgh Search

Carnegie Museum of Art

Matching 1000 records | Pages **1** 2 3 4 5 6 7 8 9 10 **Next»** | Note selection

1 CMA-59085

Inscription on Kodak Royal Pan film box reads "May - 56." Charlene Foggie Barnett identified location (visit 7/16/2008). Published in the Pittsburgh Courier Newspaper, March 31, 1956, page A1.
[Group portrait including, left to right, guest speaker and director of the Washington D.C. NAACP office, Clarence Mitchell, Pittsburgh Mayor David L. Lawrence, executive secretary of the Pittsburgh NAACP affiliate, Marion Bond Jordon, Pittsburgh NAACP president, Rev. Charles H. Foggie, Pittsburgh councilman and chairman of the dinner, Paul F. Jones, and Pittsburgh NAACP executive board member, John Golightly, gathered for the Human Rights Dinner at Gateway Plaza, Downtown]

2 CMA-56466

Published in Pittsburgh Courier Newspaper, September 1954, page 1. Inscription on Kodak Super Panchro Press film box reads "Courier Aug 54"
[Pittsburgh Mayor David L. Lawrence signing the proclamation declaring September 5 - 10 Urban League Week, seated with him are Pittsburgh Urban League board members, Jessie Vann, and Henry Pearson, standing over are, Pittsburgh Urban League secretary, Mrs. Nathaniel Dandridge, and Councilman and Pittsburgh Urban League president, Patrick T. Fagan, gathered in the Office of the Mayor at the City County Building, Downtown]

3 CMA-60163

Inscription on Kodak Royal Pan film box reads "May 57". Published in the Pittsburgh Courier Newspaper, May 23, 1959, page A15.
[Group portrait of four women from the Pittsburgh Club of Negro Business and Professional Women, including, from left to right, Marion Sappington Bryant, Wilnette B. Price, Florence Allen Holmes, and Blanche Russell Crayton, Pittsburgh Club of the Negro Business and Professional Women, gathered for the Founders Day Breakfast in the Pittsburgh Room at the Penn Sheraton Hotel]

4 CMA-17297

Published in the Pittsburgh Courier Newspaper, January 12, 1946, page 1.
[Pittsburgh Mayor David L. Lawrence swearing in Robert E. "Pappy" Williams in Pittsburgh City Council Chambers at the City County Building, Downtown]

5 CMA-36776

Note on Pittsburgh Courier paper attached to negatives reads " Pitt Gad. [University of Pittsburgh Graduates], Feb. '52"
[Group portrait of four men wearing dark graduation gowns and mortar boards, possibly University of Pittsburgh graduates]

6 CMA-36779

Note on Pittsburgh Courier paper attached to negatives reads " Pitt Gad. [University of Pittsburgh Graduates], Feb. '52"
[Portrait of woman wearing dark graduation gown and mortar board, standing between two plaques,possibly University of Pittsburgh graduate]

7 CMA-36780

Note on Pittsburgh Courier paper attached to negatives reads " Pitt Gad. [University of Pittsburgh Gr

Query Terms

pittsburgh (1000)

Named Entities

Who | Where | When | What

A. H. Burchfield » Ani Howell » Aug 54 » Blanche Russell Crayton » Booker » Chairman » Charles H. Foggie » Clarence Mitchell » Councilman » Courier » Courier Newspaper » Dapper Dan » David L. Lawrence » David W. Walker » Delilah Court » Eugene Geller » Executive Board Member » Executive Secretary » Florence Allen Holmes » Garland » Graduates » Guest Speaker » Harry Kenny » Henry Pearson » J. H. Campbell » James Hamlett » John Golightly » Leonard Wright » Man » Marion Sappington

Total 0 NE selected

Apply Filter | Clear Filters

Task Model Notes

Note something to put it here

http://ir.exp.sis.pitt.edu/namesieve_cma/

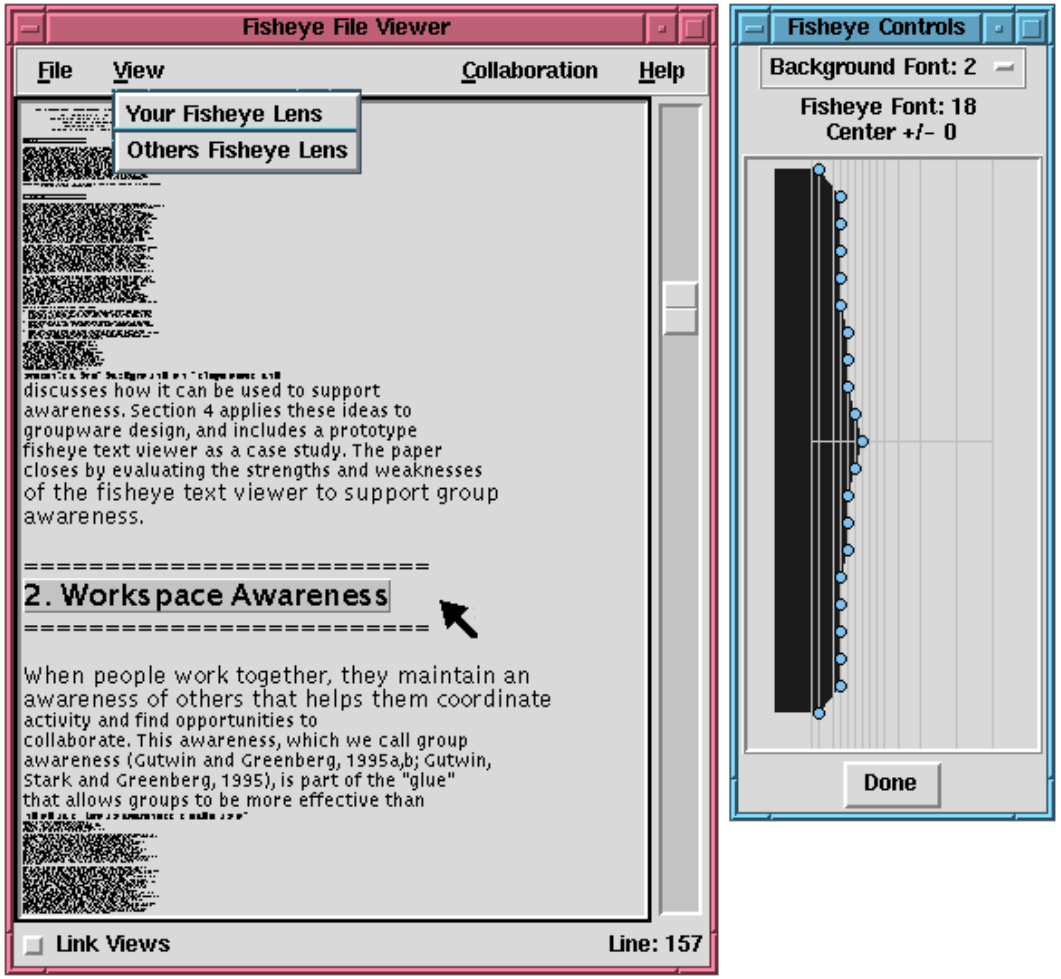
Result Examination Interfaces

- Present result documents in details
  - Text window to show the content
  - KWIC in documents
- To help presenting long documents
  - "Best passage" function helps users get started
    - Overlapping 300 word passages work well
  - Often visualization techniques are used

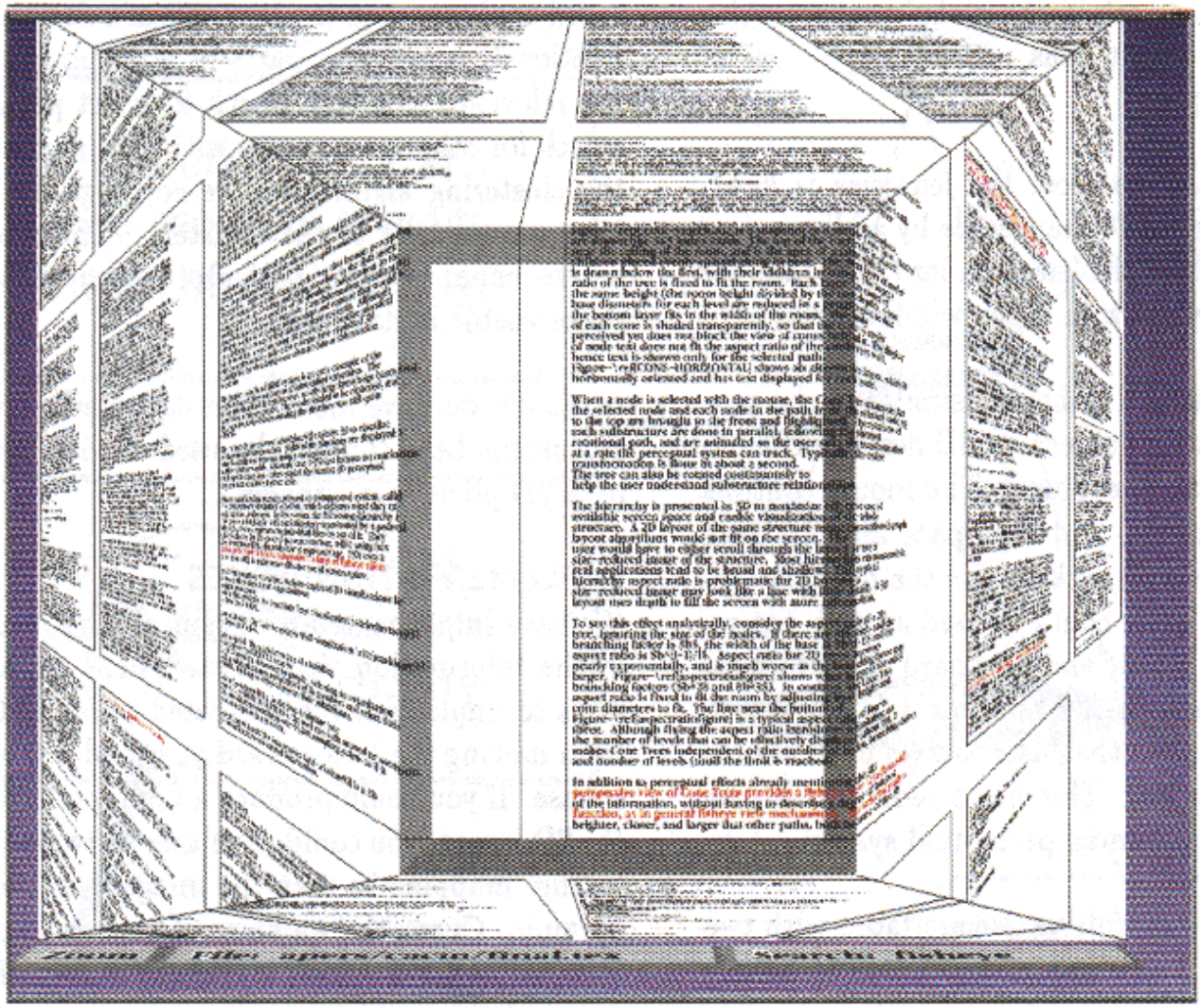
Overview + Details in ICDL

http://www.icdlbooks.org/

Fisheye Views of Documents



The Document Lens



http://doi.acm.org/10.1145/168642.168652

http://www.scils.rutgers.edu/~aspoerri/Teaching/InfoVisResources/images/visiontothink/infosphere/document_robertson/index.htm

Mobile Search Interface

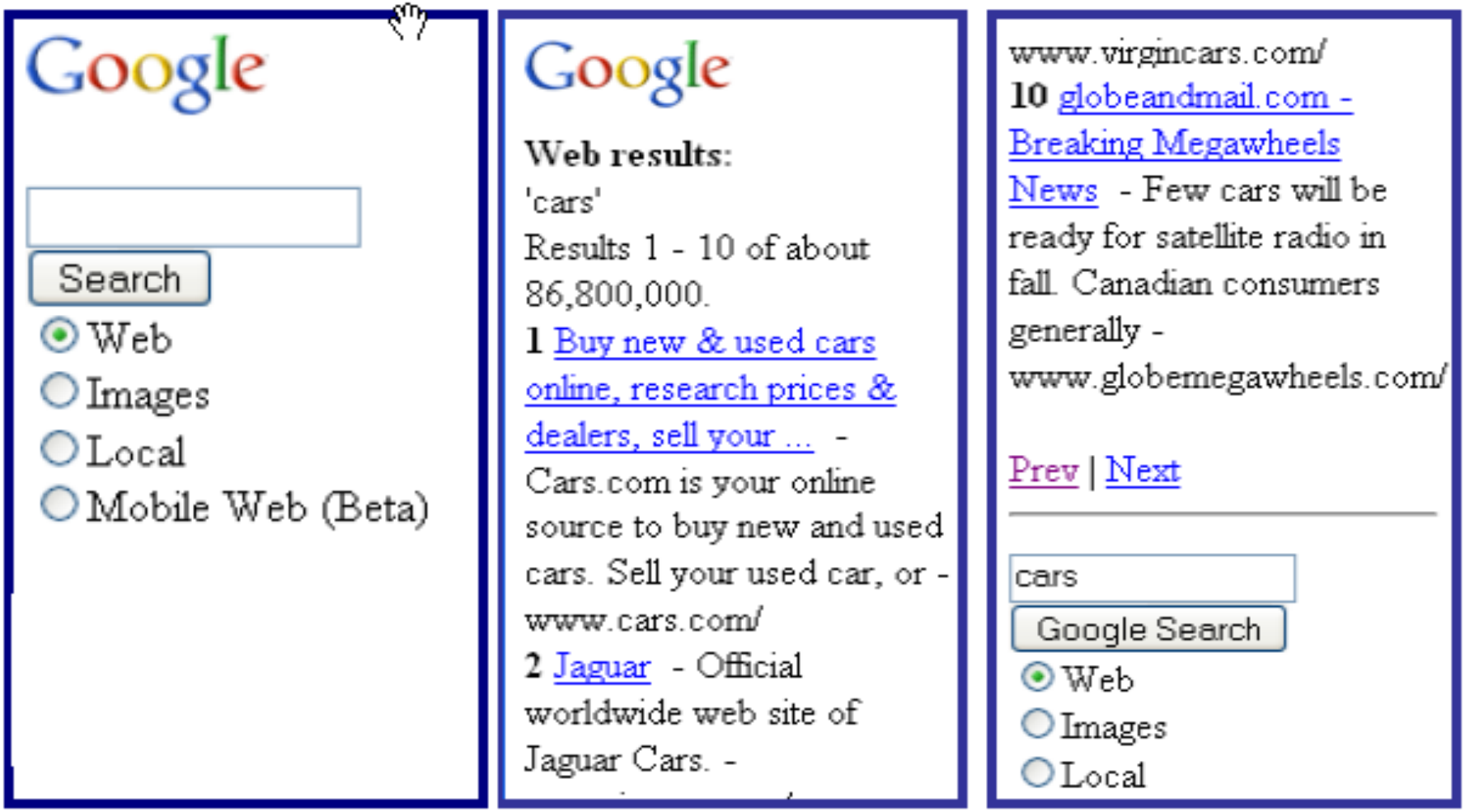
Mobile search interfaces

- Increasingly popular
  - Predict by 2020, most people will use mobile system to access internet
- Just emerge
  - Only in the past 4-5 years, relative large, high resolution screen become popular, such as iphone, ipad, etc.
- A testbed for new technologies
  - Android mobile operating system
  - Siri speech recognition system

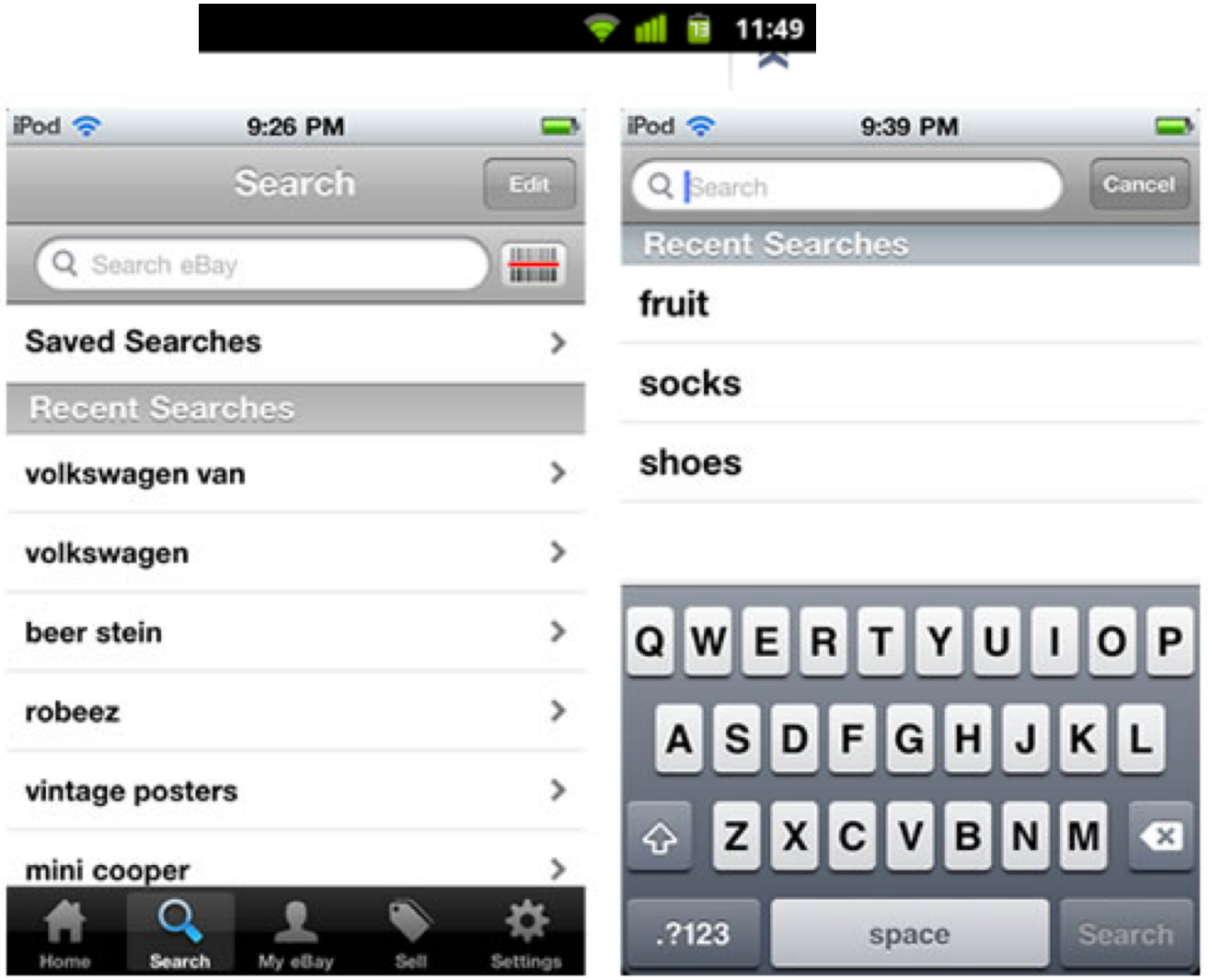
Mobile Search Usages

- Unique information needs
  - Information: Temporal and geolocation information can be the focus
  - Needs: route-finding, planning, related to current location
    - Answer questions that came up in current activity, location, time and conversation
- More focused, more repeated queries
  - Most frequent 1000 mobile queries account 22% of all mobile queries
    - In contrast, most frequent 1000 desktop queries account 6%
- Shallower interactions with results
  - Fewer page views per query
  - But more rely on current context

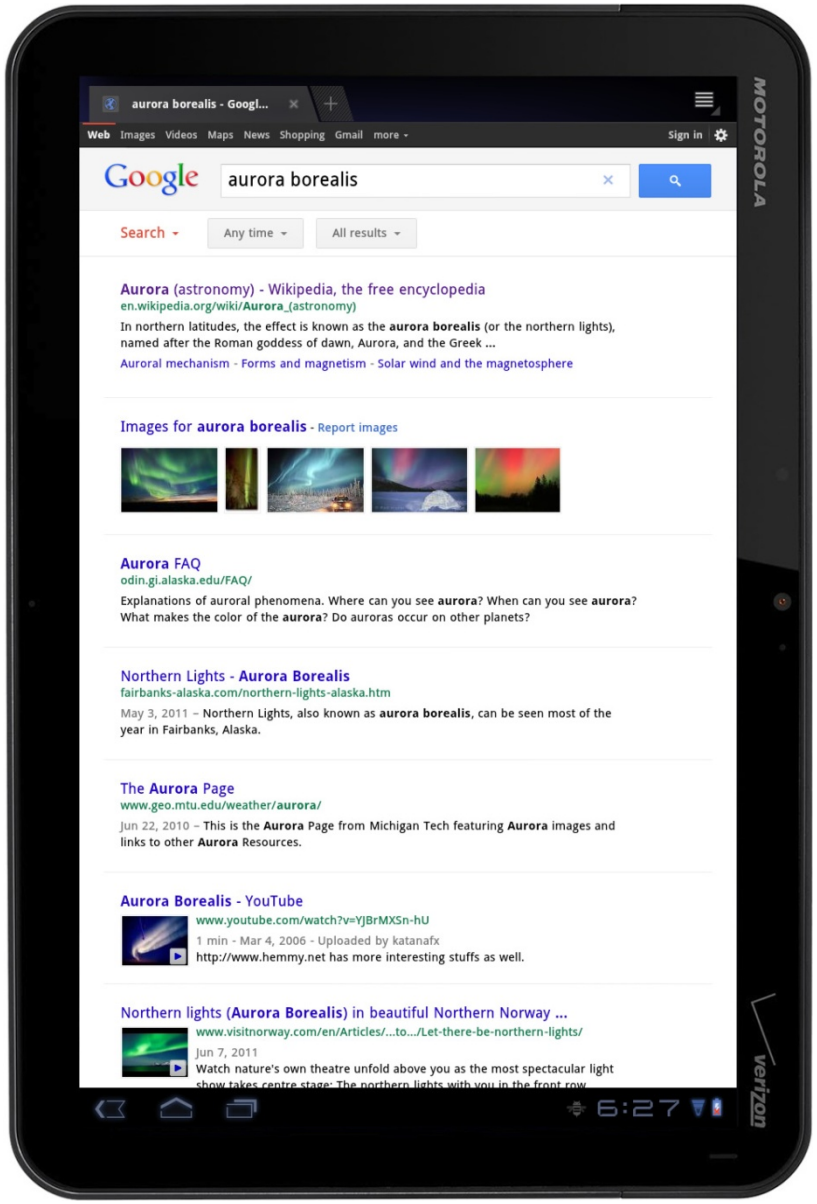
Old Google Interface

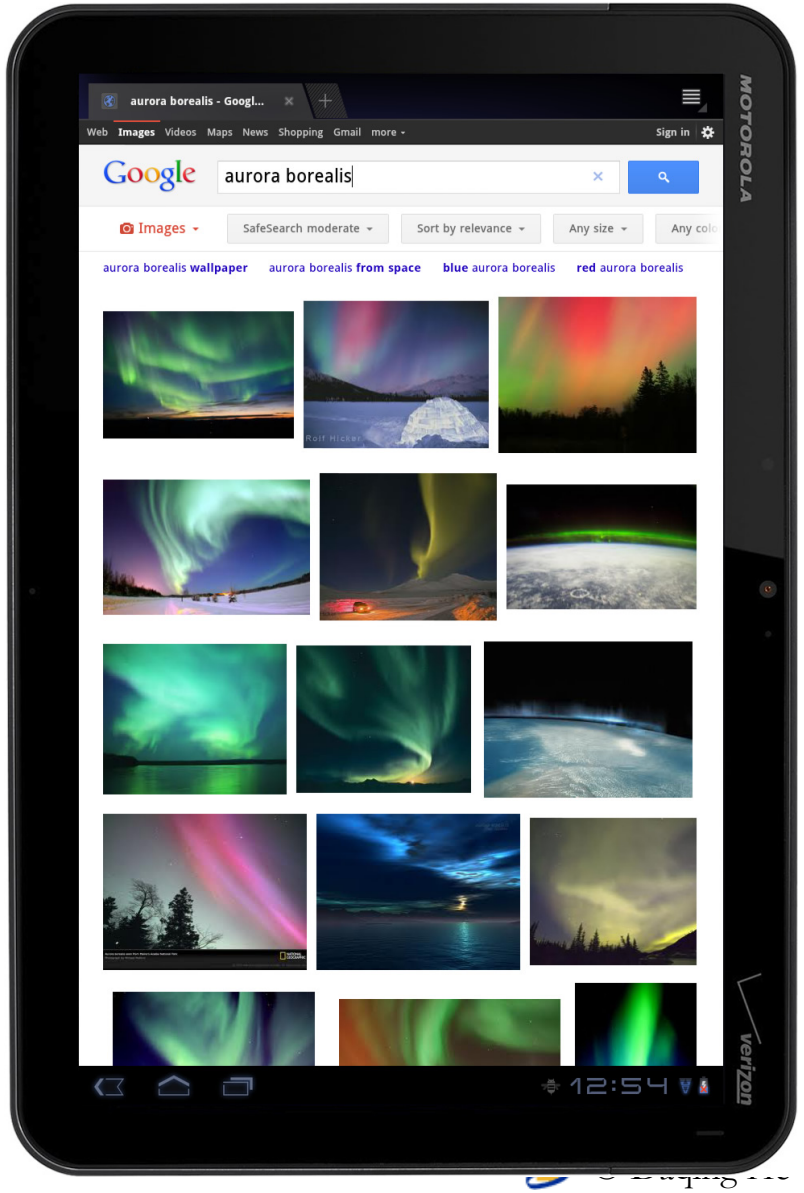


New Google Search Interface

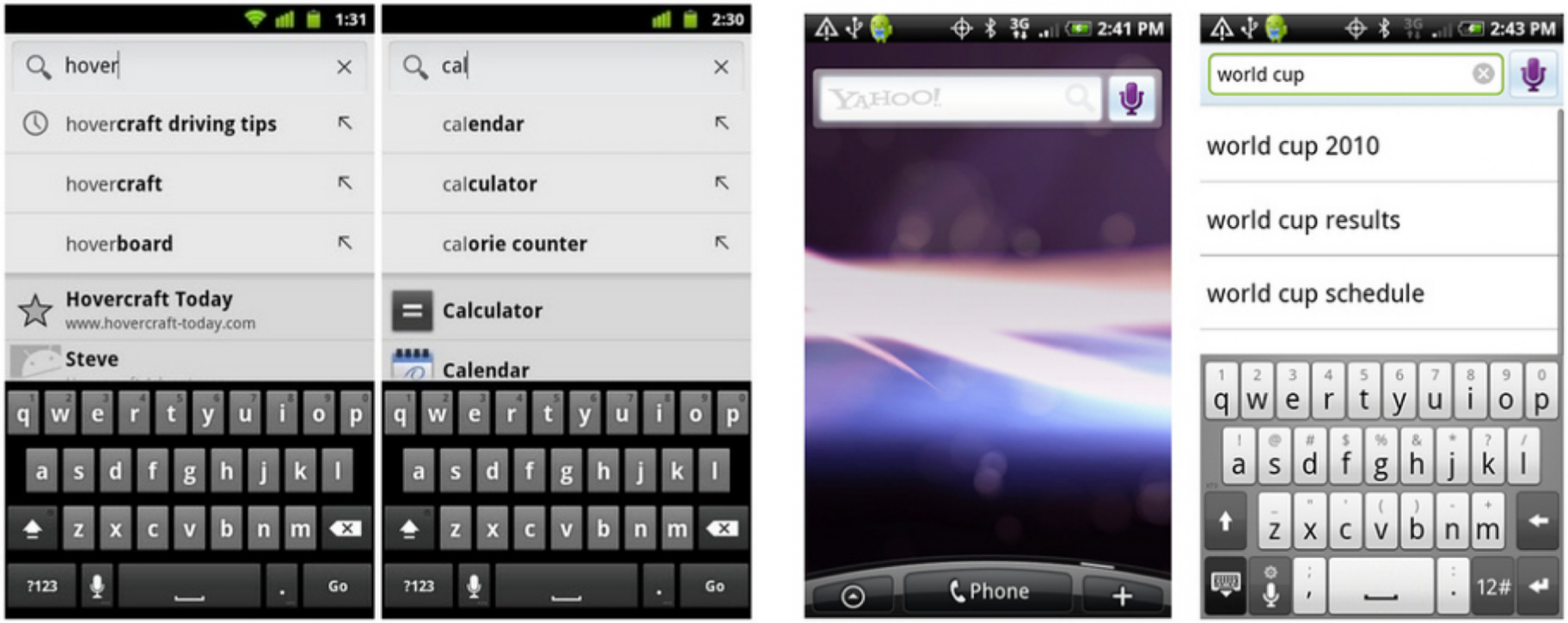


The Boston Terrier is a breed of dog originating in the United States of America.

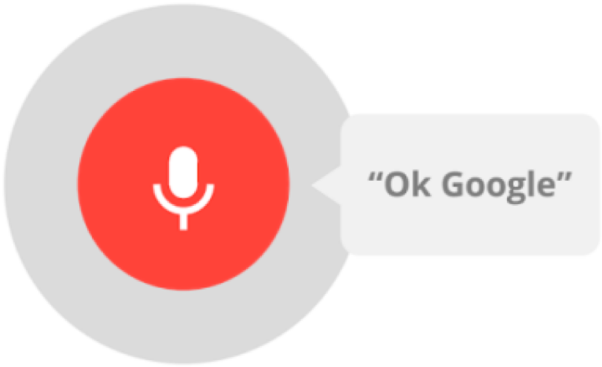

aurora borealis - Googl...
Web Images Videos Maps News Shopping Gmail more
Sign in
Google
aurora borealis
Search
Any time
All results
Aurora (astronomy) - Wikipedia, the free encyclopedia
en.wikipedia.org/wiki/Aurora_(astronomy)
In northern latitudes, the effect is known as the aurora borealis (or the northern lights), named after the Roman goddess of dawn, Aurora, and the Greek ...
Auroral mechanism - Forms and magnetism - Solar wind and the magnetosphere
Images for aurora borealis - Report images
Aurora FAQ
odin.gi.alaska.edu/FAQ/
Explanations of auroral phenomena. Where can you see aurora? When can you see aurora? What makes the color of the aurora? Do auroras occur on other planets?
Northern Lights - Aurora Borealis
fairbanks-alaska.com/northern-lights-alaska.htm
May 3, 2011 – Northern Lights, also known as aurora borealis, can be seen most of the year in Fairbanks, Alaska.
The Aurora Page
www.geo.mtu.edu/weather/aurora/
Jun 22, 2010 – This is the Aurora Page from Michigan Tech featuring Aurora images and links to other Aurora Resources.
Aurora Borealis - YouTube
www.youtube.com/watch?v=YJBrMXSn-hU
1 min - Mar 4, 2006 - Uploaded by katanafx
http://www.hemmy.net has more interesting stuffs as well.
Northern lights (Aurora Borealis) in beautiful Northern Norway ...
www.visitnorway.com/en/Articles/...to.../Let-there-be-northern-lights/
Jun 7, 2011
Watch nature's own theatre unfold above you as the most spectacular light
MOTOROLA
verizon
6:27

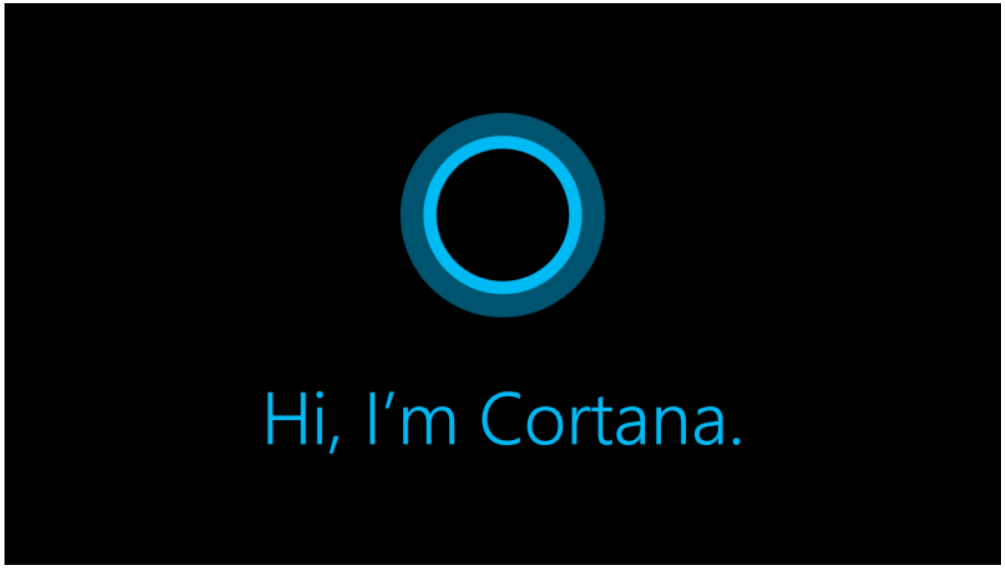

aurora borealis - Googl...
Web Images Videos Maps News Shopping Gmail more
Sign in
Google
aurora borealis
Images
SafeSearch moderate
Sort by relevance
Any size
aurora borealis wallpaper
aurora borealis from space
blue aurora borealis
red aurora borealis
MOTOROLA
verizon
12:54

Query Auto-Completion

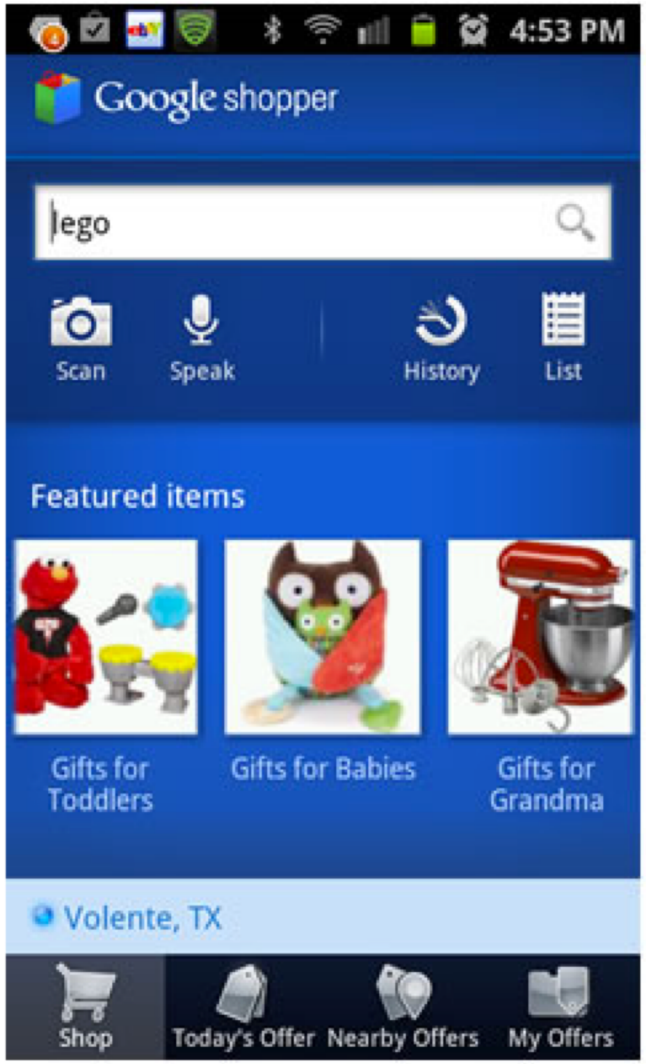


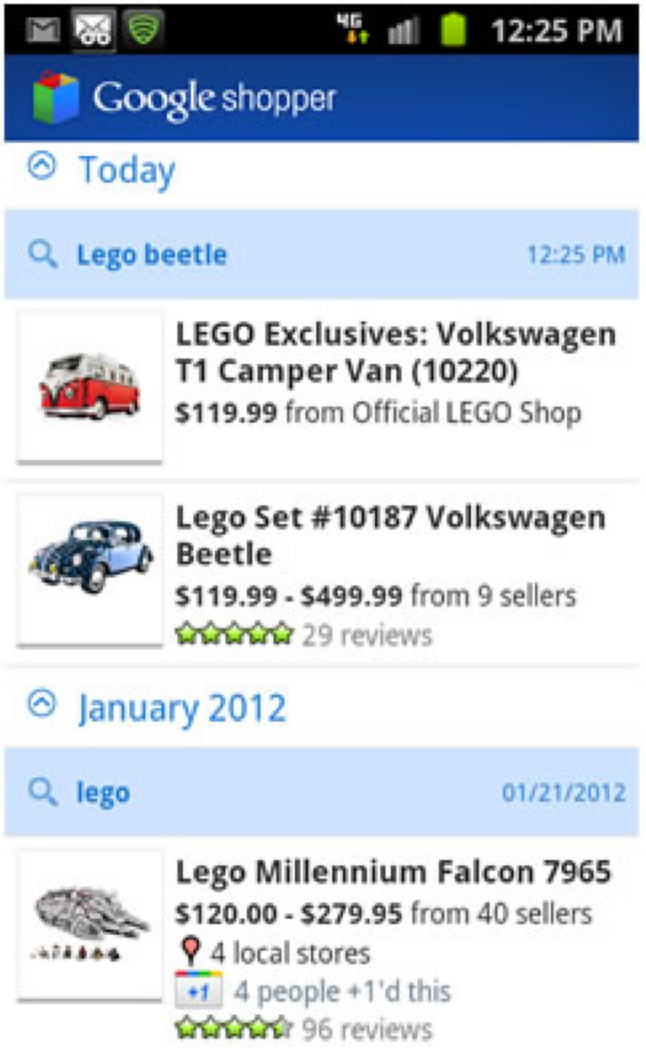
Speech based Search Input



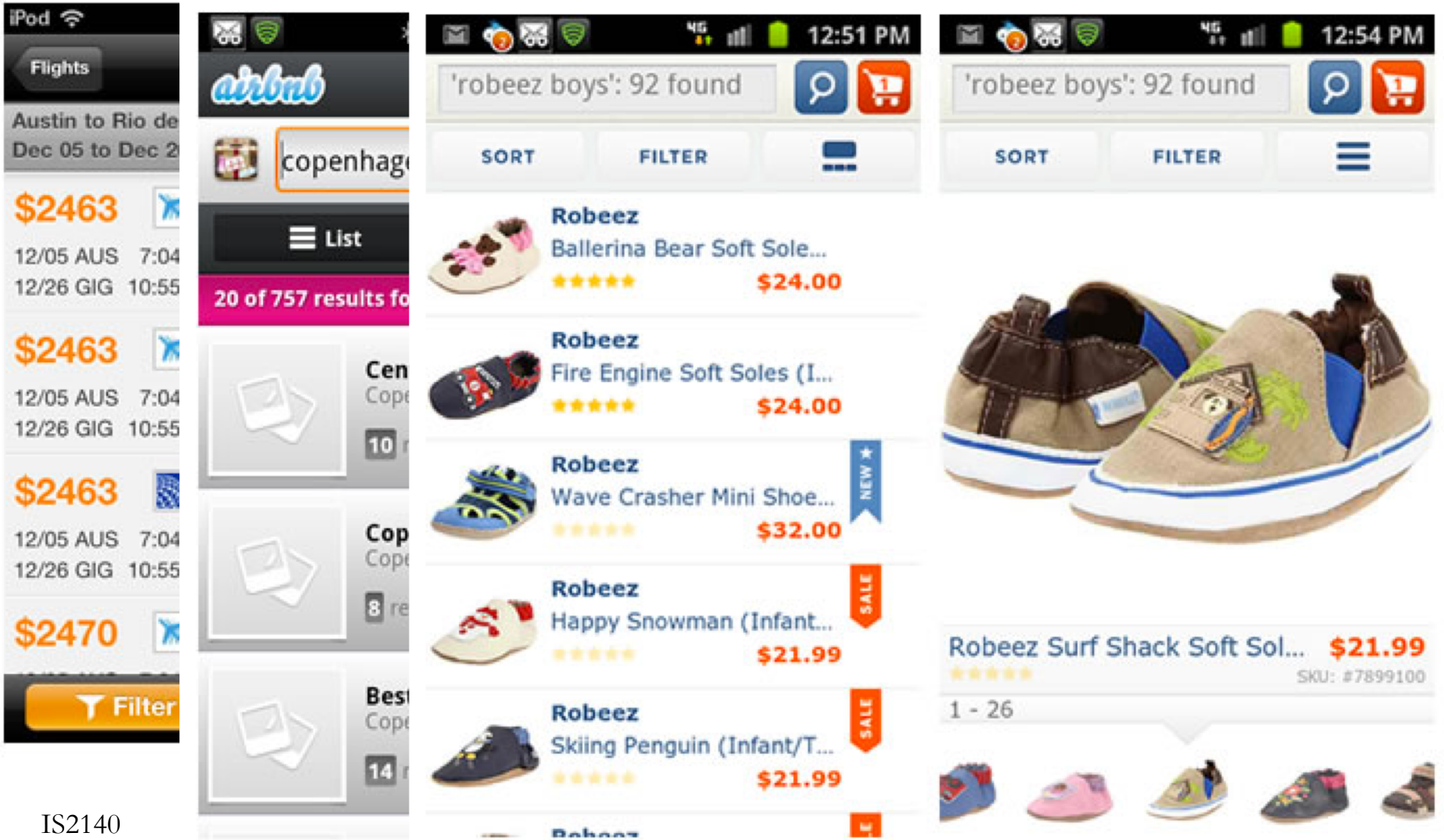


Context-based Search: Location

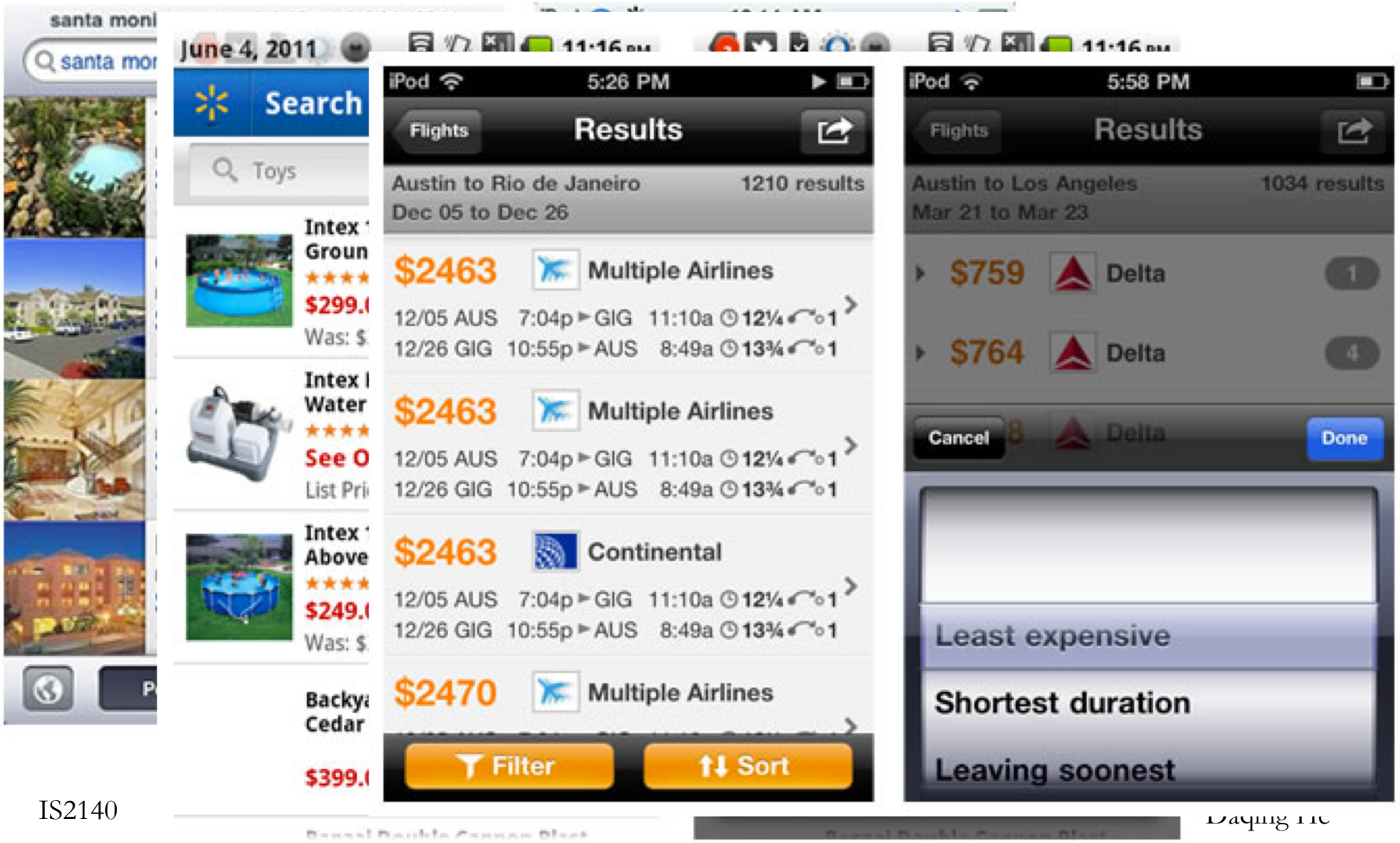




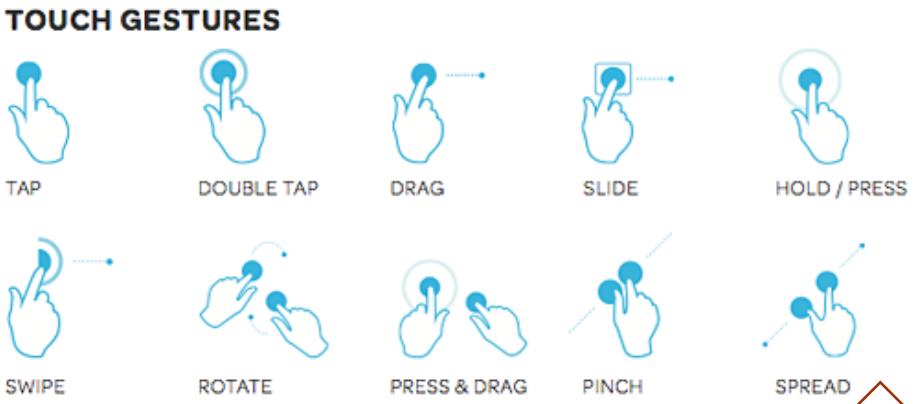
Search Results

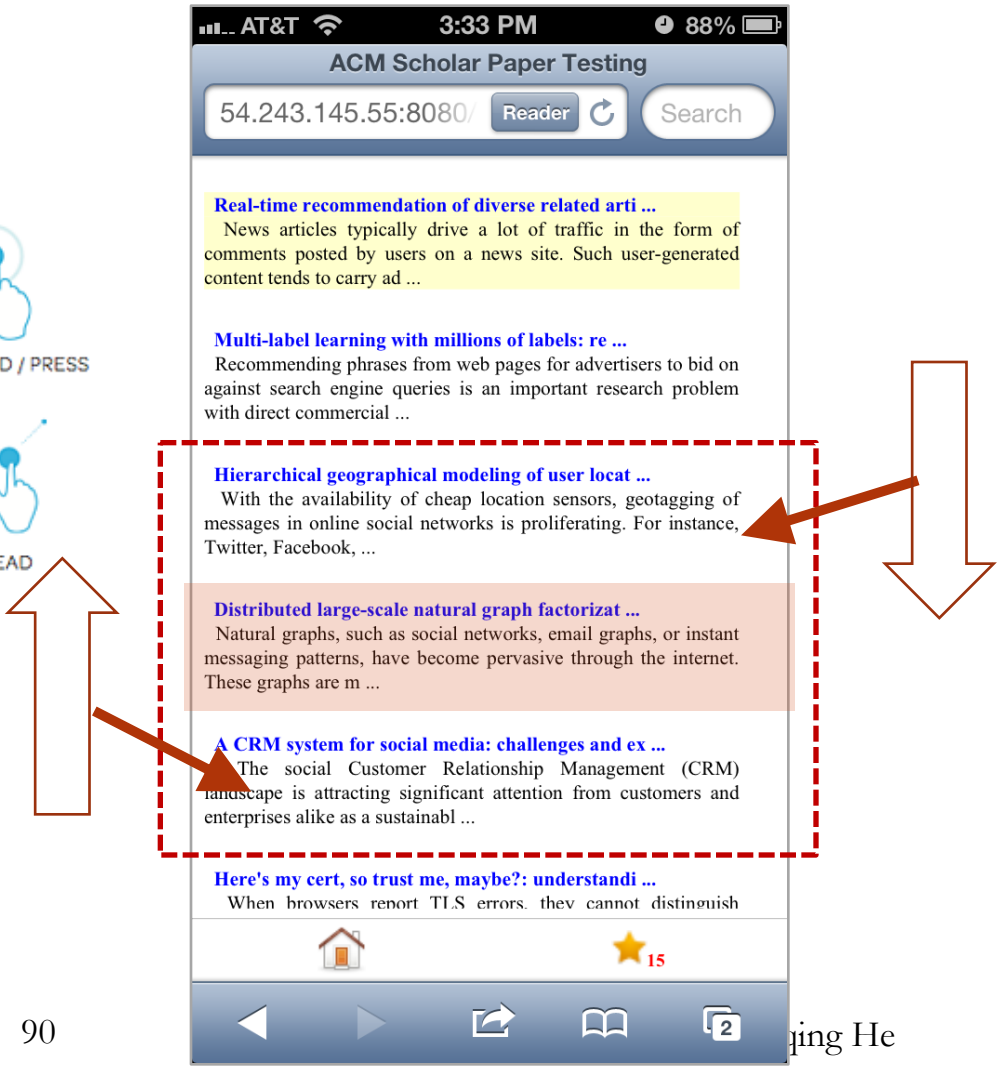


Sorting Results



Mobile Touch Interactions





Further Topics on Mobile Search

- Mobile information seeking behaviors
  - Small screen/keyboard size make it difficult to type keywords. Studies found that people did not issue shorter queries, why ?
  - Spent much more time on reading a web page
  - Clicked more high-quality documents
- Cross-device web search
  - People often migrated tasks from one device to another
- Utilizing unique information in mobile web search
  - Contextual information
  - Mobile touch interactions

Evaluating Interactive IR Systems

Evaluation Dimensions

- Three dimensions of **usability**
  - Effectiveness: Accuracy and completeness with which users achieve specified goals.
  - Efficiency: Resources expended in relation to the accuracy and completeness with which users achieve goals (usually, how much time).
  - Satisfactory: Freedom from discomfort, and positive attitudes towards the use of the product.
- Evaluation Methods
  - Standard IR metrics – precision, recall, nDCG and etc.
  - Informal usability test – interview, filed study in early stage
  - Formal usability test – controlled user experiments (user study)
  - Search log analysis and A/B Testing

Controlled User Study

- Techniques in User Study
  - IRB (Institutional review board)
  - Consent form
  - Training task
  - Pilot study
- Balance condition ordering effects
  - Removing learning effects, fatigue effects and task effects
  - Latin Square ordering
- Obtaining participants
- Obtain participants subjective responses
  - Cognitive load
  - Satisfactory

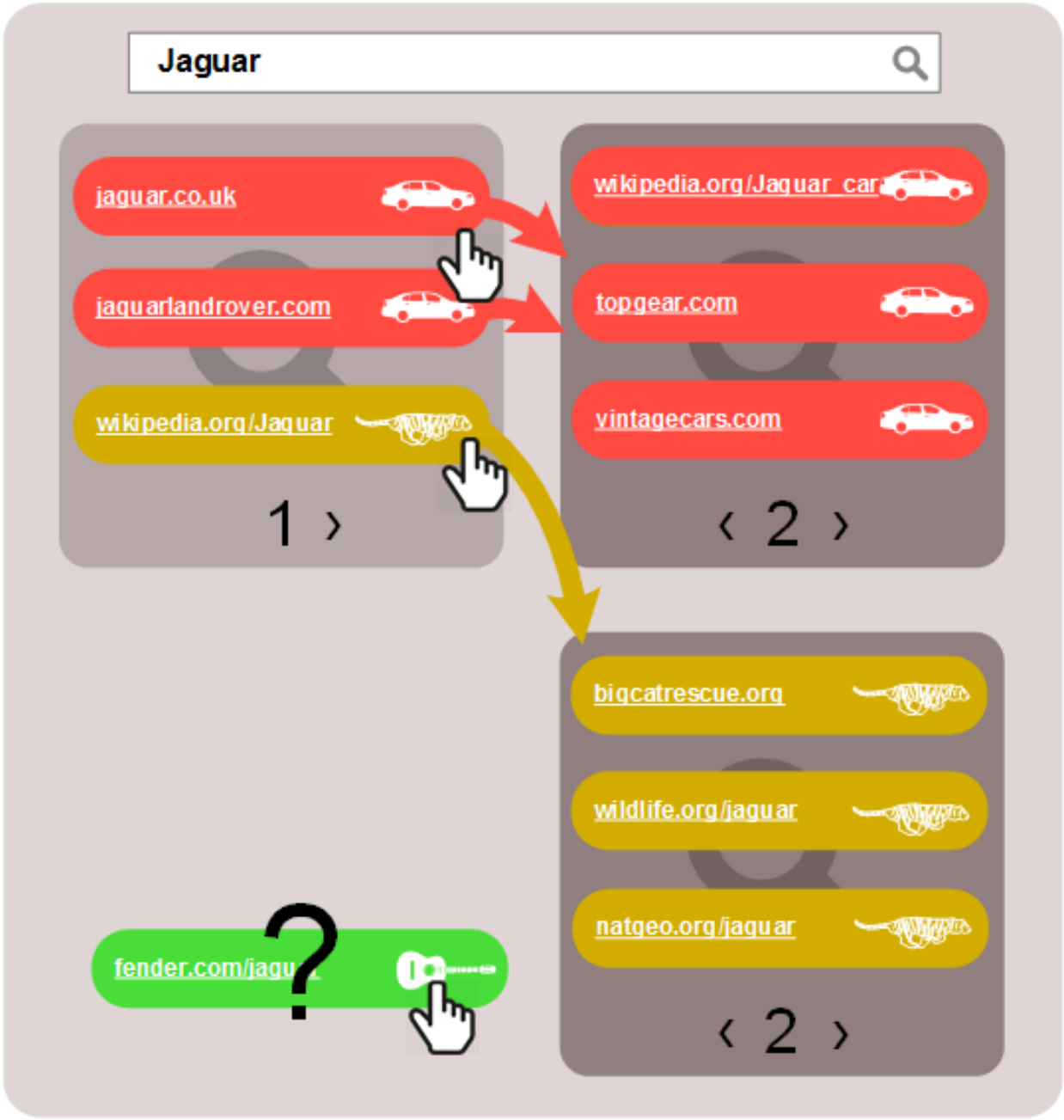
Summary

Synergy between Human and IR system

- The strength of one covers the weakness of the other
  - Humans do things that human are good at
  - Computers do things that computers are good at
- What human good at?
  - Sense low level stimuli, Recognize patterns, Reason inductively, Communicate with multiple channels, Apply multiple strategies, Adapt to changes or unexpected events
- What machine good at?
  - Sense stimuli outside human's range, Calculate fast and mechanical, Store large quantities and recall accurately, Response rapidly and consistently, Perform repetitive actions reliably, Maintain performance under heavy load and extended time

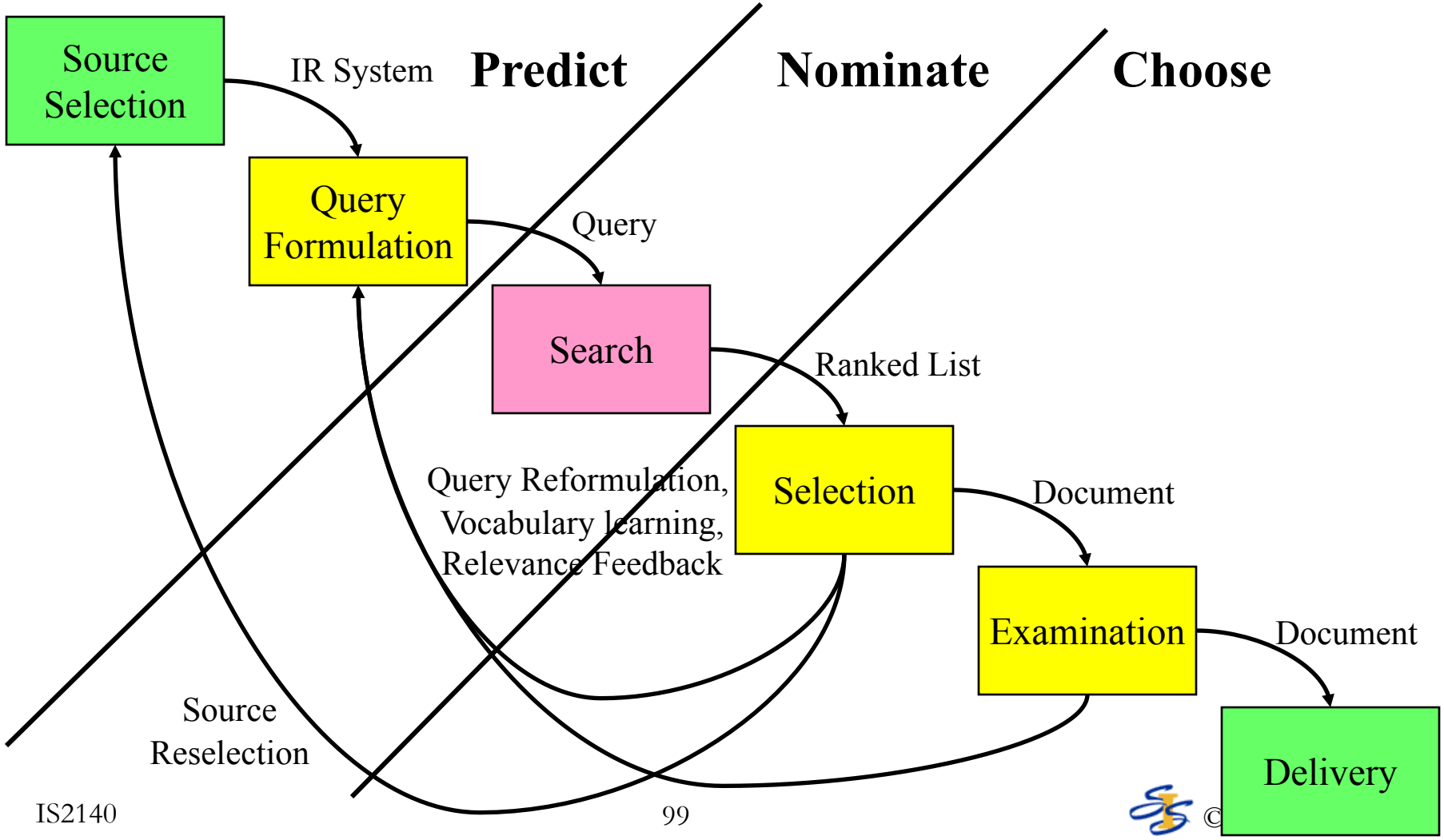
The Importance of Interfaces

- The user interface is the part of the system that the user interacts with:
  - Interaction is an integral part of the information seeking process
  - Search experience is affected by the quality of the interface
- Interfaces should
  - Help users get started
  - Help users keep track of what they have done
  - Help users make sense of what the system did
  - Suggest next choices
- It is very difficult to design good UIs
- It is very difficult to evaluate search UIs



Clicked webpages lead to the personalization of the second page of results based on the subtopic clicked, but not all of the subtopics are represented.

Information Retrieval Cycle



An Example