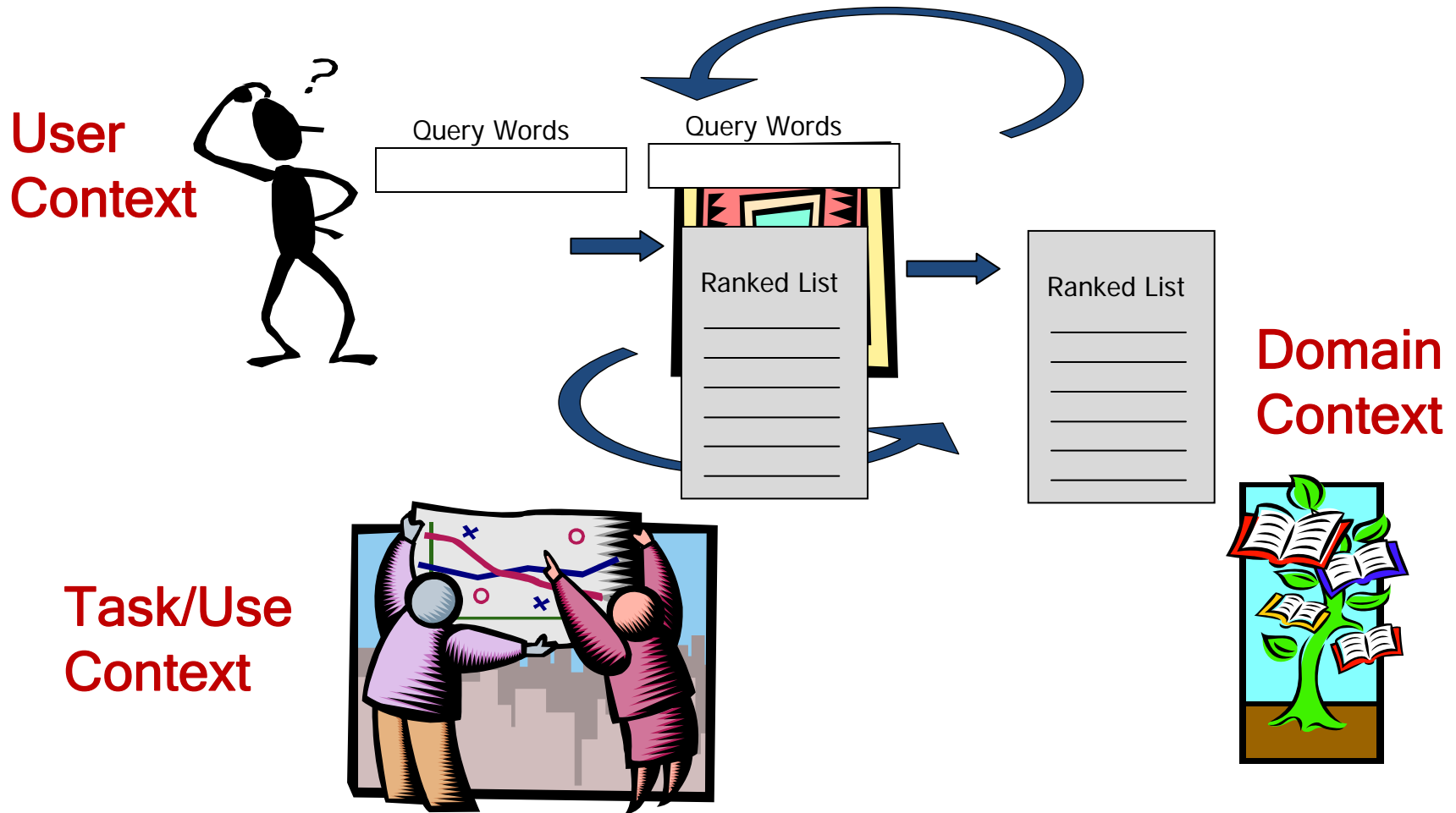


# Personalization and Search

Jaime Teevan

Microsoft Research

# Information Retrieval **> Query**

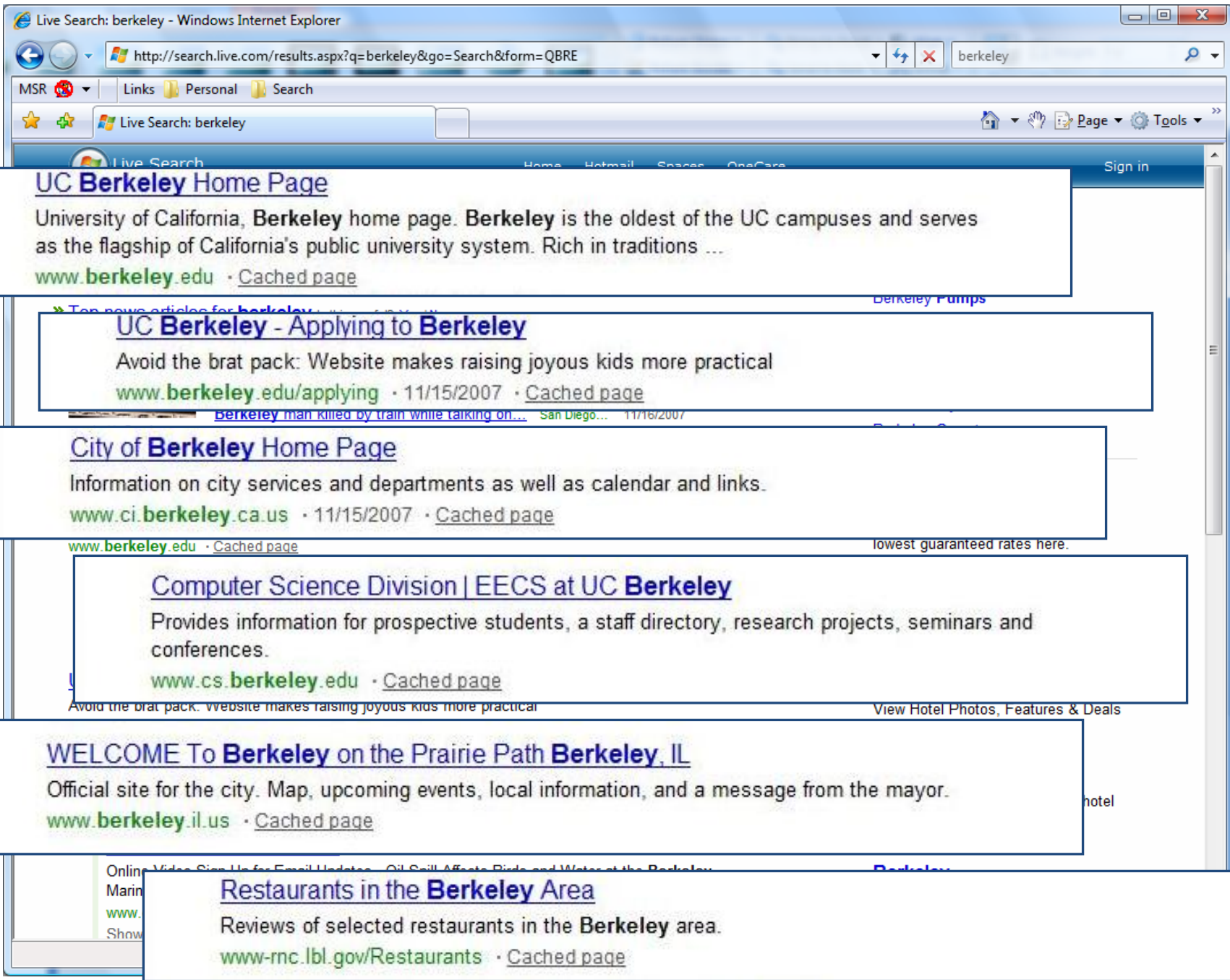


# Personalization and Search

- Measuring the value of personalization
  - Do people's notions of relevance vary?
- Understanding the individual
  - How can we model a person's interests?
- Calculating personal relevance
  - How can we use the model to measure relevance?
- Other ways to personalize search
  - What other aspects can we personalize?

# Personalization and Search

- Measuring the value of personalization
  - An example
  - Lots of relevant results ranked low
  - Best group ranking v. individual ranking
- Understanding the individual
- Calculating personal relevance
- Other ways to personalize search



### [UC Berkeley Home Page](#)

University of California, **Berkeley** home page. **Berkeley** is the oldest of the UC campuses and serves as the flagship of California's public university system. Rich in traditions ...

[www.berkeley.edu](http://www.berkeley.edu) · [Cached page](#)

### [UC Berkeley - Applying to Berkeley](#)

Avoid the brat pack: Website makes raising joyous kids more practical

[www.berkeley.edu/applying](http://www.berkeley.edu/applying) · 11/15/2007 · [Cached page](#)

### [City of Berkeley Home Page](#)

Information on city services and departments as well as calendar and links.

[www.ci.berkeley.ca.us](http://www.ci.berkeley.ca.us) · 11/15/2007 · [Cached page](#)

### [Computer Science Division | EECS at UC Berkeley](#)

Provides information for prospective students, a staff directory, research projects, seminars and conferences.

[www.cs.berkeley.edu](http://www.cs.berkeley.edu) · [Cached page](#)

### [WELCOME To Berkeley on the Prairie Path Berkeley, IL](#)

Official site for the city. Map, upcoming events, local information, and a message from the mayor.

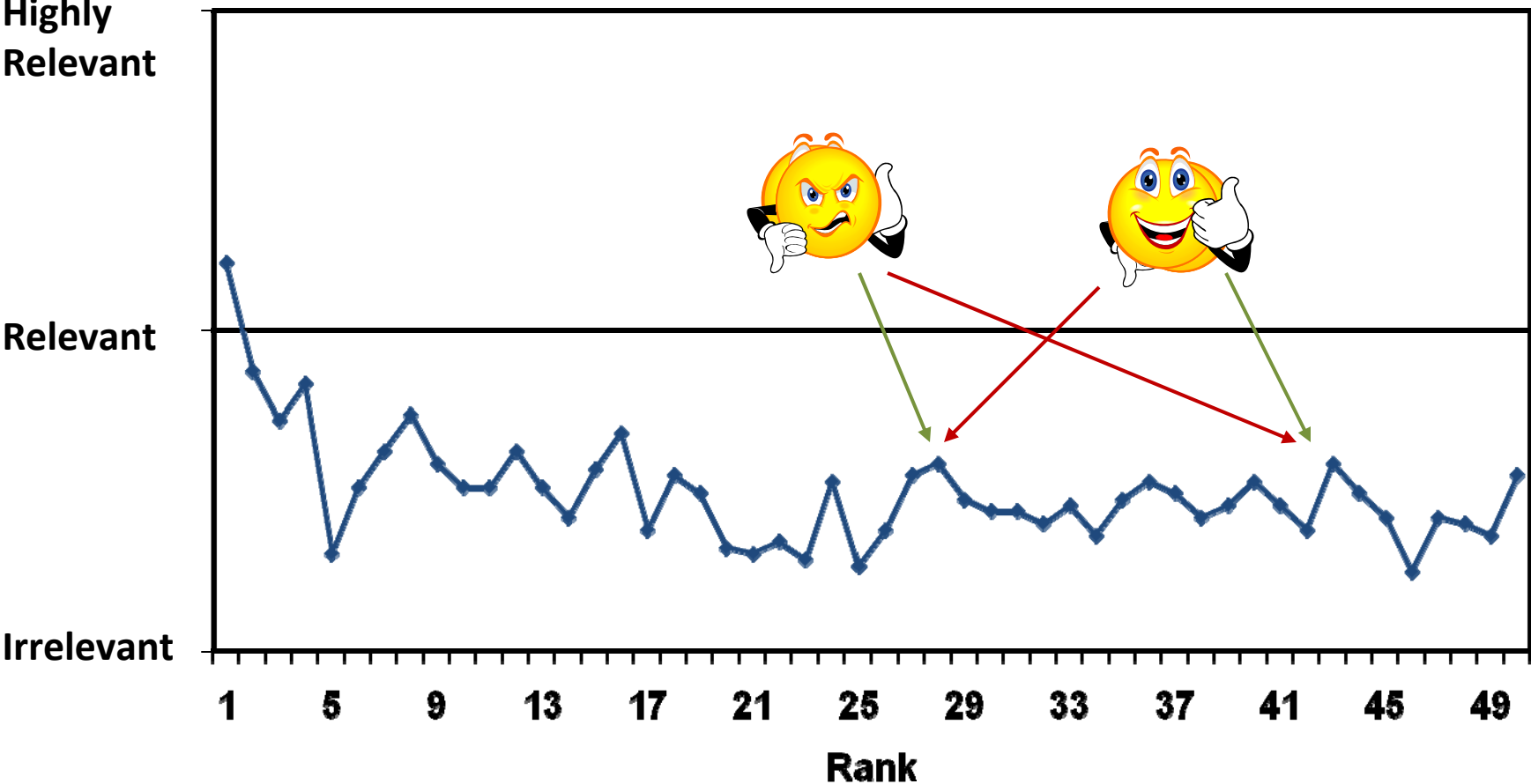
[www.berkeley.il.us](http://www.berkeley.il.us) · [Cached page](#)

### [Restaurants in the Berkeley Area](#)

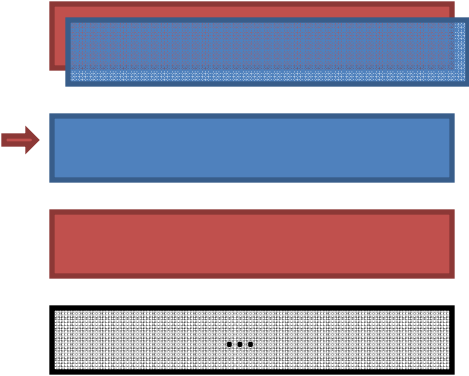
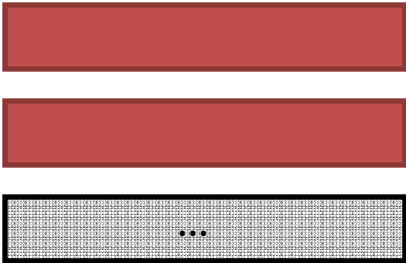
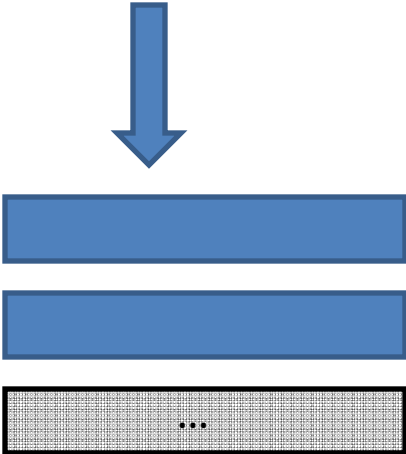
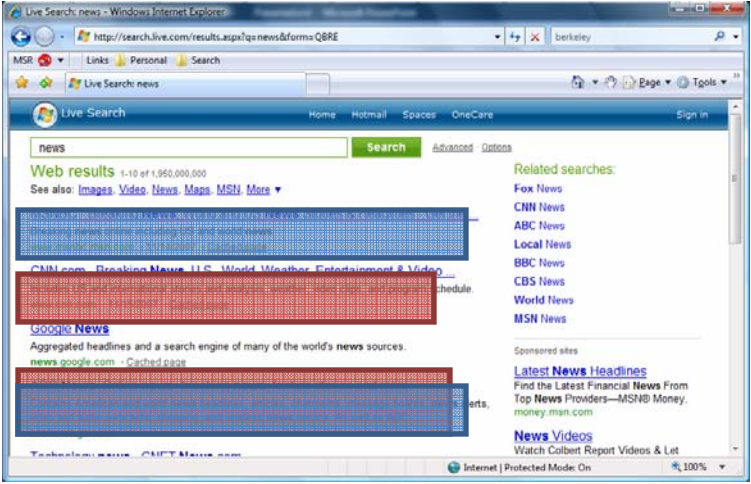
Reviews of selected restaurants in the **Berkeley** area.

[www-rnc.lbl.gov/Restaurants](http://www-rnc.lbl.gov/Restaurants) · [Cached page](#)

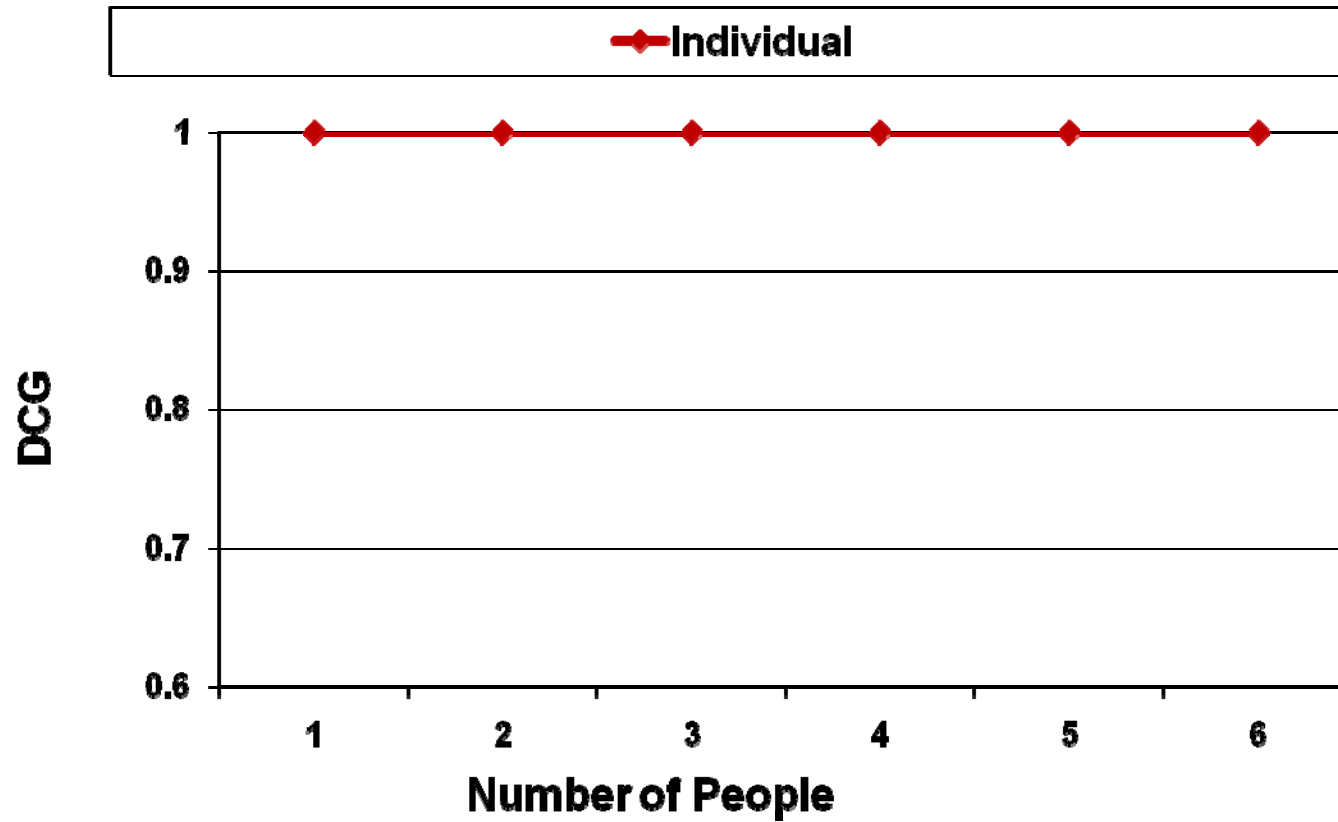
# Relevant Content Ranked Low



# Best Rankings

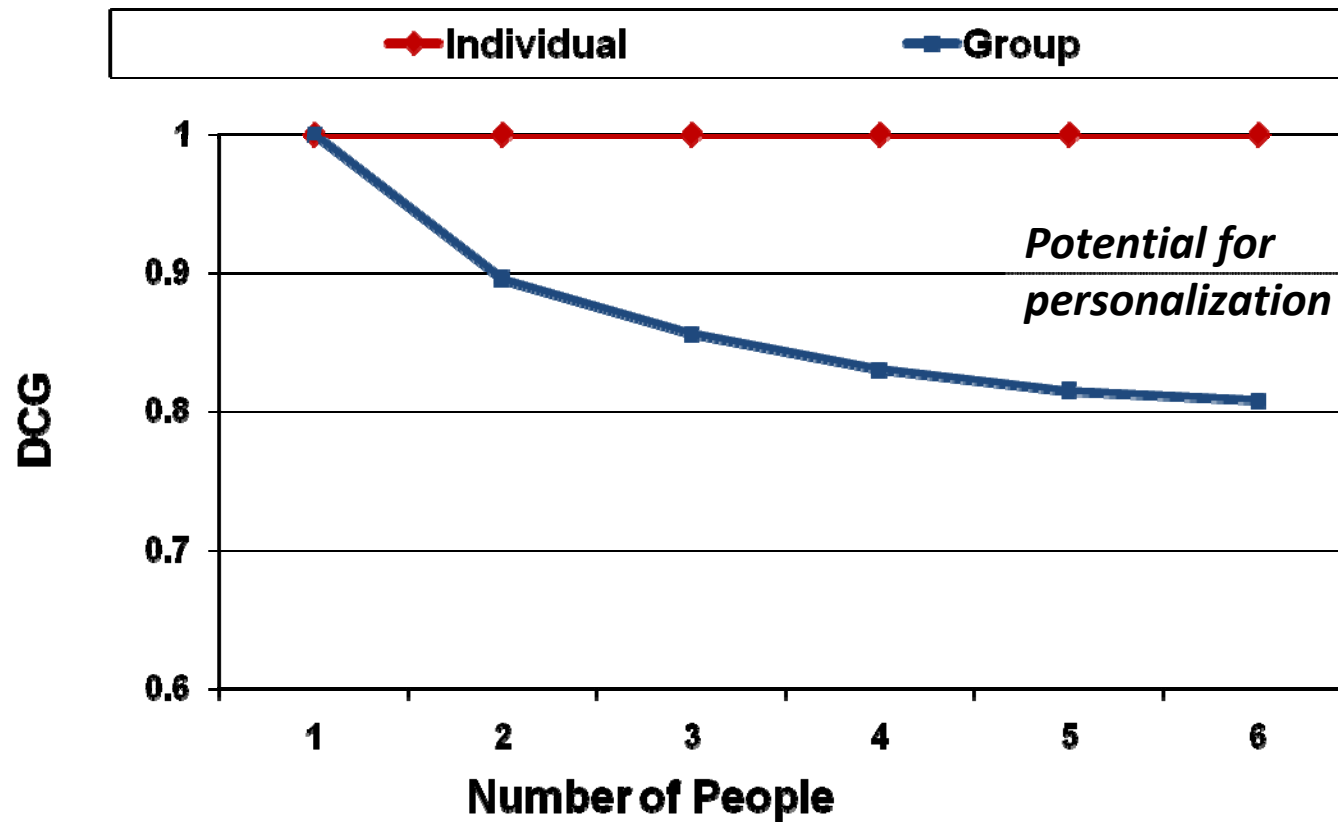


# Potential for Personalization

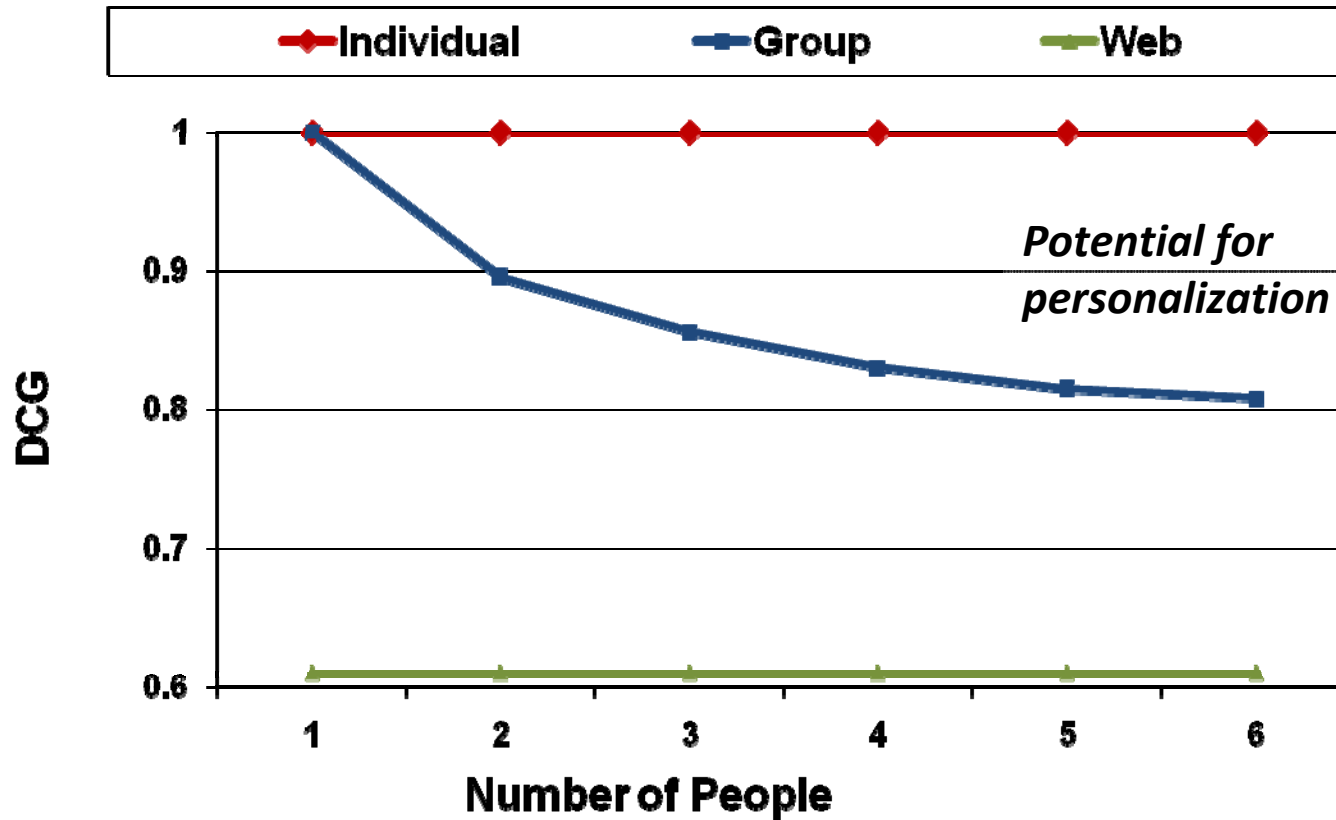




# Potential for Personalization



# Potential for Personalization

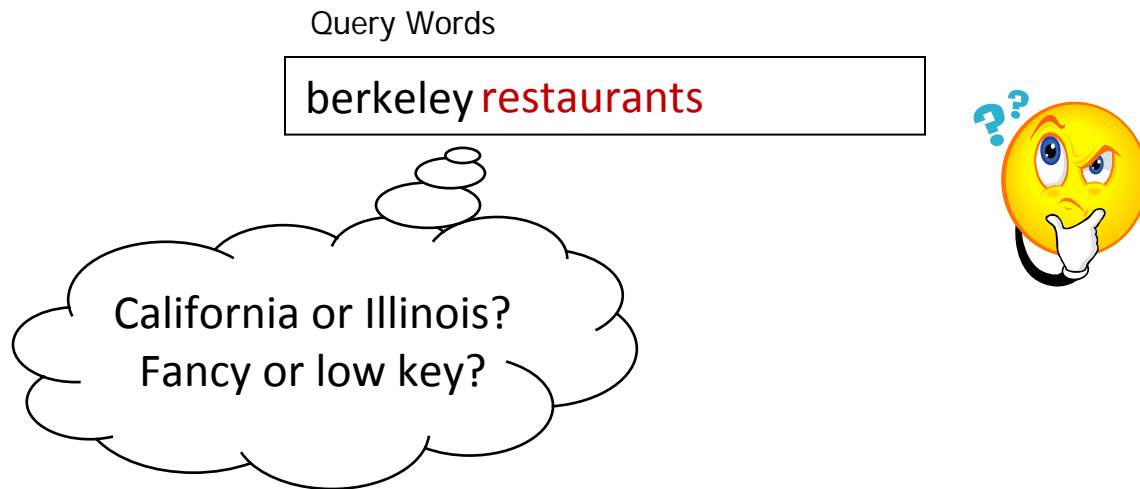


# Overview

- Measuring the value of personalization
- Understanding the individual
  - Gather information beyond the query
  - Explicit v. implicit
  - Client-side v. server-side
- Calculating personal relevance
- Other ways to personalize search

# Learning More Explicitly v. Implicitly

- Explicit
  - User shares more about query intent
  - User shares more about interests
  - Hard to express interests explicitly



# Learning More Explicitly v. Implicitly

- Explicit

- User shares more about query intent

- User shares more about interests

Intellectual property?

- Hard to express interests explicitly

Rock climbing?

*Tobacco and guns*

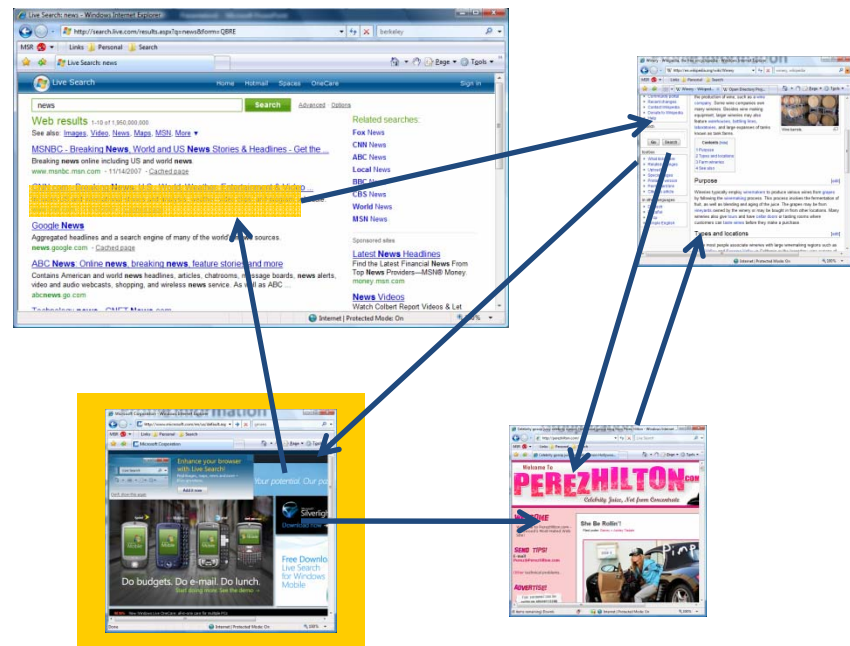
Arts	Business	Computers
Games	Health	Home
Kids and Teens	News	Recreation
Reference	Regional	Science
Shopping	Society	Sports

# Learning More Explicitly v. Implicitly

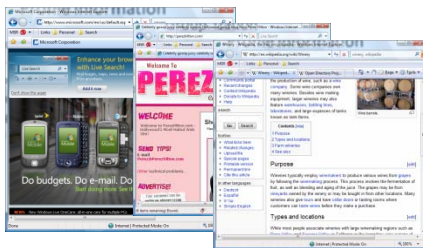
- Explicit
  - User shares more about query intent
  - User shares more about interests
  - Hard to express interests explicitly
- Implicit
  - Query context inferred
  - Profile inferred about the user
  - Less accurate, needs lots of data

# Profile Information

- Behavior-based
  - Click-through
  - Personal PageRank
- Content-based
  - Categories
  - Term vector



[topic: computers]



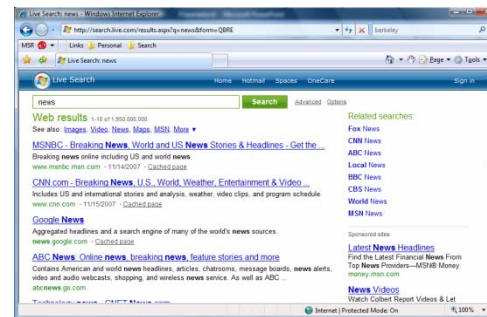
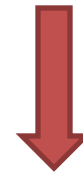
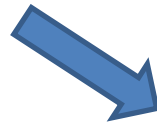
→ [computers: 2, microsoft: 1, click: 4, what: 3, tablet: 1]

# Profile Information

- Behavior-based
  - Click-through
  - Personal PageRank
- Content-based
  - Categories
  - Term vector

# Server information

- Web page index
- Link graph
- Group behavior



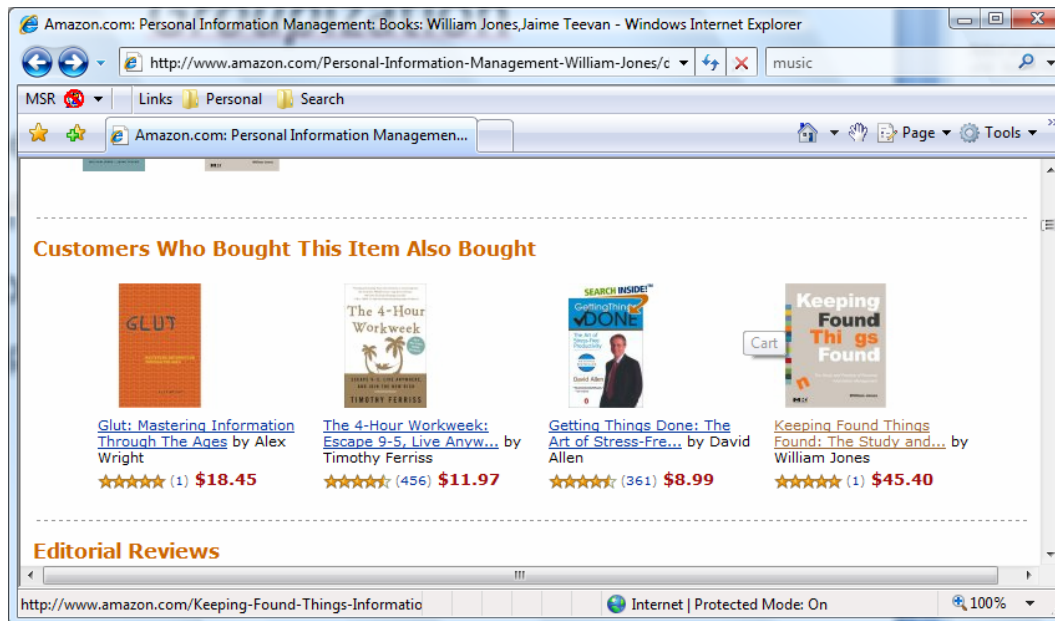


# Server-Side v. Client-Side Profile

- **Server-side**
  - Pros: Access to rich Web/group information
  - Cons: Personal data stored by someone else
- **Client-side**
  - Pros: Privacy
  - Cons: Need to approximate Web statistics
- **Hybrid solutions**
  - Server sends necessary Web statistics
  - Client sends some profile information to server

# Match Individual to Group

- Can use groups of people to get more data
- Back off from individual → group → all
- Collaborative filtering



# Overview

- Measuring the value of personalization
- Understanding the individual
- **Calculating personal relevance**
  - Behavior-based example
  - Content-based example
- Other ways to personalize search

# Behavior-Based Relevance

- People often want to re-find
- People have trusted sites
- Boost previously viewed URLs

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# Content-Based Relevance

- Explicit relevance feedback
  - Mark documents relevant
  - Used to re-weight term frequencies

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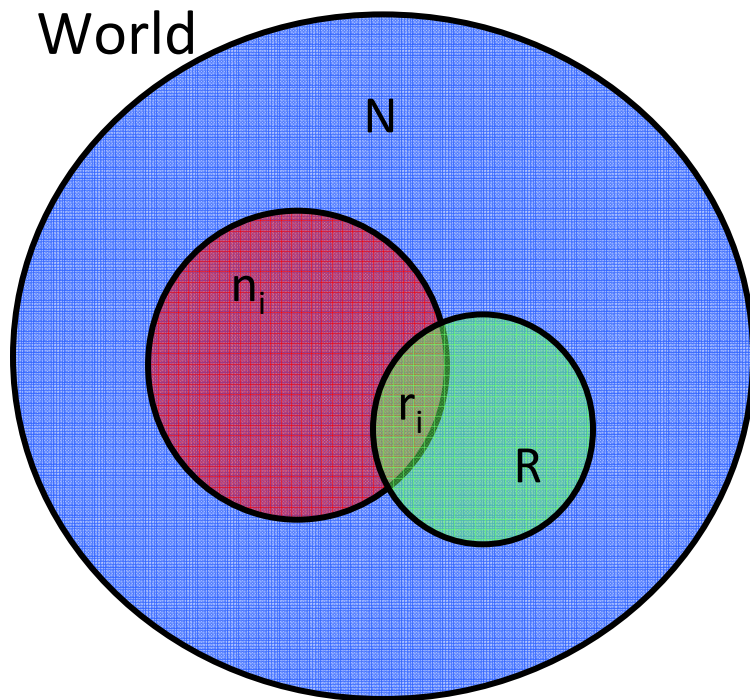
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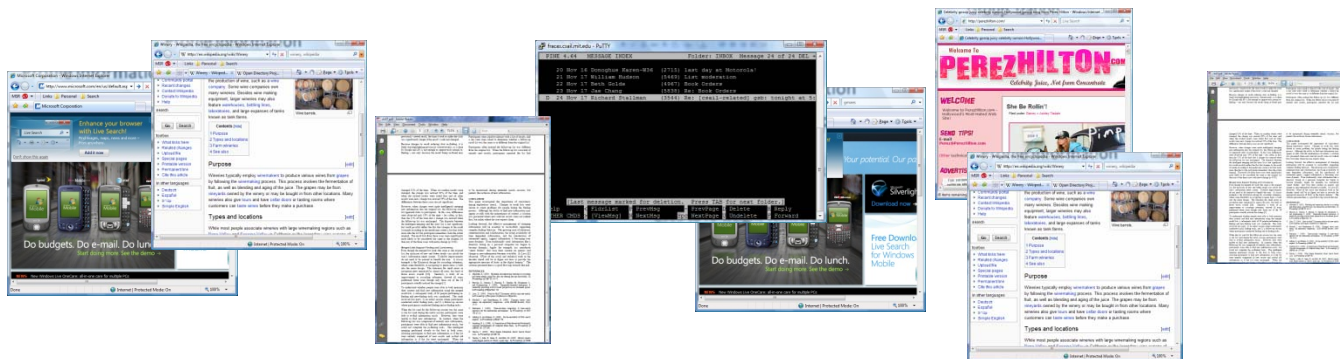
$$\text{Score} = \sum \text{tf}_i * w_i$$

$$w_i = \log \frac{(N)}{(n_i)}$$

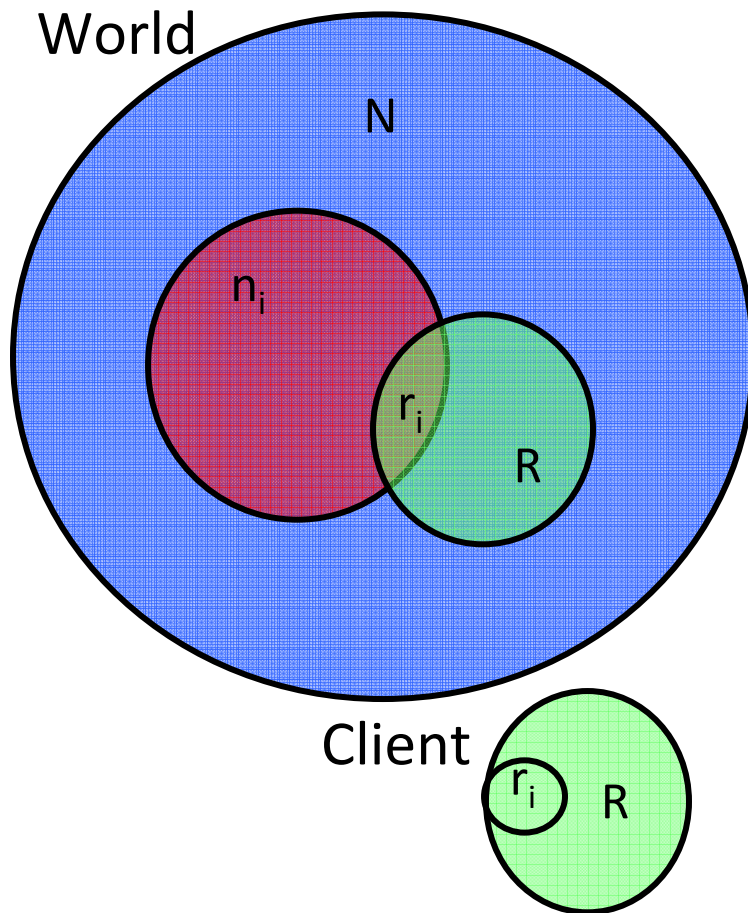
$$w_i = \log \frac{(r_i+0.5)(N-n_i-R+r_i+0.5)}{(n_i-r_i+0.5)(R-r_i+0.5)}$$

# Content-Based Relevance

- Explicit relevance feedback
  - Mark documents relevant
  - Used to re-weight term frequencies
- Lots of information about the user
  - Consider read documents relevant
  - Use to re-weight term frequencies



# Content-Based Relevance



$$\text{Score} = \sum \text{tf}_i * w_i$$

$$w_i = \log \frac{(N)}{(n_i)}$$

$$w_i = \log \frac{(r_i+0.5)(N-n_i-R+r_i+0.5)}{(n_i-r_i+0.5)(R-r_i+0.5)}$$

$$w_i = \log \frac{(r_i+0.5)(N'-n'_i-R+r_i+0.5)}{(n'_i-r_i+0.5)(R-r_i+0.5)}$$

Where:  $N' = N+R$ ,  $n'_i = n_i+r_i$



# Personalization Performance

- Personalized search hard to evaluate
- Mostly small improvements despite big gap
- Identify ambiguous queries
  - Personalize: “berkeley”
  - Don’t personalize: “uc berkeley homepage”
- Identify easily personalized queries
  - Re-finding queries

# Other Ways to Personalize

- Measuring the value of personalization
- Understanding the individual
- Calculating personal relevance
- **Other ways to personalize search**
  - Match expectation for re-finding queries
  - Personalized snippets

# Ranking Results for Re-Finding

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<http://breastcancer.about.com/>

[Hormone therapy treatment for breast cancer](#)  
Hormonal therapies include ... estrogens, ovarian treatments, aromatase inhibitors (newer drugs that are ... Hormone treatment has been proved to reduce the risk of breast cancer coming back. ...  
<http://www.breasthealth.com.au/treatment/hormonotherapy.html>

[Treatments for Breast Cancer](#)  
A look at the treatments for breast cancer with resources for learning more ... Health> Women and Cancer> Cancer Types A-Z> Breast Cancer> Treatments ... Treatments are always changing ...  
[http://womenshealth.about.com/library/treatments/bltreatments\\_breastcancer.htm](http://womenshealth.about.com/library/treatments/bltreatments_breastcancer.htm)

[Radiation Treatments for Breast Cancer](#)  
Links to resources will cover the different forms of radiation treatment for breast cancer. Information on radiation or radiotherapy treatments for breast cancer can be found in the resources listed below. ...  
[http://www.healthinsite.gov.au/topics/Radiation\\_Treatments\\_for\\_Breast\\_Cancer](http://www.healthinsite.gov.au/topics/Radiation_Treatments_for_Breast_Cancer)



# Snippets to Support Re-Finding

Query: “winery”

[Winery - Wikipedia, the free encyclopedia](#)

A **winery** is a building or property that produces wine, or a business involved in the production of wine, such as a wine company. Some wine companies own many wineries. Besides wine making equipment ...

[en.wikipedia.org/wiki/Winery](http://en.wikipedia.org/wiki/Winery)

If the person has visited the page before:

[Winery - Wikipedia, the free encyclopedia](#) Last visit: November 14, 2007

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New content: It has been suggested that Winery wastewater be merged into this article or section.

[en.wikipedia.org/wiki/Winery](https://en.wikipedia.org/wiki/Winery)

# Interest-Based Snippets

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[en.wikipedia.org/wiki/Winery](https://en.wikipedia.org/wiki/Winery)

If the person is interested in Maui:

[Winery - Wikipedia, the free encyclopedia](#)

A **winery** is a building or property that produces wine, or a business involved in the production of wine, such as a wine company... For example, in Maui there is a pineapple **winery**. ...

[en.wikipedia.org/wiki/Winery](https://en.wikipedia.org/wiki/Winery)

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# Summary

- Measuring the value of personalization
  - There's a big gap between group and individual
- Understanding the individual
  - Building a profile, explicit v. implicit
- Calculating personal relevance
  - Relevance feedback, boost click through
- Other ways to personalize search
  - Rank based on expectation, personalized snippets