First, let’s hear from you

- What kinds of sites or products do you work on?
- What do you hope to take away from today’s workshop?
This workshop builds on what I have learned from projects over the last 7+ years

- Search at The Open University (2002 – 2009)
  - Large, diverse web site with many different reasons people might use search
- General searches for health information (2002-2009)
  - Several projects for different types of sites: pharmaceutical, general health sites and government health info sites
- Cancer clinicals trials search (2005-2008)
  - Detailed information in a complex medical domain

Designing for Search

Search is the new normal
Googlification

There is no need to know
Because we can find

Does search put users in charge of their own work, or does it decrease chances of success?

“Users now have precise expectations for the behavior of search... Search is such a prominent part of the Web user experience that users have developed a firm mental model for how it's supposed to work.”

- Jakob Nielsen, 2005

“If most of the users don't find what they want in the first try, it doesn't seem likely they will ever find it.”

- Jared Spool, 2001
In 2002-2003, we were surprised by a strong desire for a search feature

- More participants wanted search than we had expected
- Those who use search regularly were adamant about wanting search
- They had opinions about where the search box should be placed
- Many were influenced by having a search engine as their browser start page

"I think I might have to type it in"
"I want to see a box...like a search box"
"I guess my question is, do they have a search"
"I do miss being able to just type somewhere...I could get to it quicker if I were able to search"

Research with older suburban women on general health sites, 2002

Is “search” the right question, or should we be thinking about helping people “find”?

Their sites have search engines. Ours has a find engine.
Search is more than a technology problem. We need to look at users, context and behavior.

Sometimes search can be a failure of navigation

- The Open University case study
April 2006 “student home” gone from top searches

“Designing for Search

Models for search

“If you help a lot of people find the content they seek, you improve the overall efficiency of the organization.”

– Richard Wiggins

Whitney Quesenbery  whitneyq@WQusability.com  www.WQusability.com
The classic information retrieval model treats search as a single, iterative task

But people are focused on their questions. Search is just a way to find answers.

NCI research on searching for clinical trials
People often alternate searching and browsing

“Orienteering” - improvisational searching, using information from each place to determine where to go next

People use search as a home base for exploration, choosing many different sites to visit

“Berry picking” – gathering discrete facts from many places to collect a “basket” of information
People use search as a way to jump quickly, even if they know the name of the site

- On external searches entering The Open University web site, the query included:

  - A brand marker only 86% “Open Uni”
  - A brand marker plus another term 7% “open university course”
  - A general term only 7% “creative writing”

Analysis from October 2006 logs of 396,000 queries

There is still a place for search in some kinds of tasks

“Sensemaking” – a term applied to information-intensive tasks and scientific analysis

Illustration from “Search User Interfaces” by Marti Hearst
Why do we search?

People use search for many different reasons:

- **FIND**: I know exactly what I’m looking for and just need to find it.
- **QUERY**: I can describe what I’m looking for and need a few good options.
- **ORIENTATION**: I want to see what’s available on the web (or on this site).
- **EXHAUSTIVE**: I want to make sure I’ve found everything about this topic.
**Find**

- Specific information
  - a “known item”
- Know exactly what they are looking for or believe it exists
- Have a second source of information
- Shortcut, for efficiency
- “Fish hook”

**Query**

- Information matching a question
- Often part of information gathering or “berry picking”
- May not know how to phrase the question well
- May just need a starting point for exploration
- “Lobster pot”
Orientation

- Find out what's available
- Using search to explore or browse
- Search results as a home page
  - “Tidal pool”

Exhaustive

- Looking for complete answer
  - “Recall”
  - May search across several sites, but the goal is to make sure they have found all the information available
  - “Fishing net”

http://jama.ama-assn.org/
Search without searching

- Using browsing links to initiate a search

Hunter: Looking for the Target
- “The web is a library”
- Use rapid narrowing techniques
- Often professionals or know content well
- Influenced by previous experience

Gatherers: Collecting Information
- “The web is a resource”
- Search is a launch pad to “the right stuff”
- More discriminating readers
- Tend to notice source or date

InfoSeeker: On a Journey
- “The web is a wonderland”
- Berrypickers - a page with new information is a success
- May use search to create a starting point, but with less specificity than others

Transitional: Novice Searchers
- “The web is a mystery”
- Easily frustrated
- Use of search depends on computer experience more than other personas
- Often in transition from seeker to gatherer

Lilly: consumers and professionals, 2002
A few years later, “search” had disappeared into general information seeking

<table>
<thead>
<tr>
<th>Magpies (the collectors)</th>
<th>The Unconscious Competents</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Persistent novices</td>
<td>• See themselves as novices, but have more skills than they say</td>
</tr>
<tr>
<td>• Ad-hoc exploration and orienteering</td>
<td>• Tend to be methodical</td>
</tr>
<tr>
<td>• A few favorite sites, but rely on search engines</td>
<td>• Follow patterns that have worked before</td>
</tr>
<tr>
<td>• Easily overwhelmed</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The IMpatients</th>
<th>Deeply Engaged</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Move quickly to snap judgements, but also miss things because they move too quickly</td>
<td>• Proficient searchers</td>
</tr>
<tr>
<td>• Don’t know what they don’t know</td>
<td>• Use many sources of information, including primary sources</td>
</tr>
<tr>
<td>• Read material on site to check against own knowledge</td>
<td>• Tend to be sure about their opinions.</td>
</tr>
<tr>
<td></td>
<td>• Gather things to read later</td>
</tr>
</tbody>
</table>

In later work, there is a stronger trend towards blending search and browsing

**Approach to Information Seeking**

- 6 - Strong browser
- 8 - Strong searcher
- 22 - Blended approach

National Cancer Institute, Clinical Trials Search, 2005

National Cancer Institute, 2007
How we search: The “long tail” pattern:

Search terms show a “long tail” pattern, with a few terms accounting for most of the searches.

- The top 100 searches quickly drop in frequency from 3000 instances to under 50

Analysis from 3 separate months of search logs – , Caroline Jarrett
We see the same pattern, even with the top 100 search terms: a few searches have the most use.

When we analysed the OU search logs, we found that the top terms are persistent.

Course information:
- Subject
- Department or faculty
- Qualifications and courses

Academic and calendar-related
- Finding tutorials
- Exam results
- Past exam papers
Top search terms persist from month to month, with some variations for the academic calendar

<table>
<thead>
<tr>
<th>Oct-06</th>
<th>Jan-05</th>
<th>May-04</th>
</tr>
</thead>
<tbody>
<tr>
<td>psychology</td>
<td>1</td>
<td>psychology</td>
</tr>
<tr>
<td>law</td>
<td>7</td>
<td>law</td>
</tr>
<tr>
<td>social work</td>
<td>10</td>
<td>social work</td>
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<tr>
<td>teaching</td>
<td>18</td>
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<td>14</td>
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<td>mba</td>
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</tr>
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<td>photography</td>
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<td>nutrition</td>
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</tr>
<tr>
<td>creative writing</td>
<td>8</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Oct-06</th>
<th>Jan-05</th>
<th>May-04</th>
</tr>
</thead>
<tbody>
<tr>
<td>ausa [exam papers]</td>
<td>22</td>
<td>tutorial finder</td>
</tr>
<tr>
<td>ouba [finance]</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>exam results</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

Even small groups of terms on a single subject show this pattern

<table>
<thead>
<tr>
<th>Search term</th>
<th>Number of searches</th>
</tr>
</thead>
<tbody>
<tr>
<td>classical studies</td>
<td>81</td>
</tr>
<tr>
<td>classical studies department</td>
<td>12</td>
</tr>
<tr>
<td>classical latin</td>
<td>8</td>
</tr>
<tr>
<td>classical greek</td>
<td>7</td>
</tr>
<tr>
<td>classical courses</td>
<td>7</td>
</tr>
<tr>
<td>classical greek course calendar</td>
<td>6</td>
</tr>
<tr>
<td>classical department</td>
<td>6</td>
</tr>
<tr>
<td>classical studies diploma</td>
<td>5</td>
</tr>
<tr>
<td>classical studies dept</td>
<td>3</td>
</tr>
<tr>
<td>classical studies website</td>
<td>3</td>
</tr>
<tr>
<td>classical history</td>
<td>2</td>
</tr>
<tr>
<td>classical civilisations</td>
<td>2</td>
</tr>
<tr>
<td>classical greek course calendar 2005</td>
<td>2</td>
</tr>
<tr>
<td>classical studies webpage</td>
<td>2</td>
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<tr>
<td>classical studies</td>
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<td>classicoca</td>
<td>2</td>
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<tr>
<td>classics</td>
<td>2</td>
</tr>
<tr>
<td>classic home page</td>
<td>1</td>
</tr>
<tr>
<td>classical athens</td>
<td>1</td>
</tr>
<tr>
<td>classical civilisation greek</td>
<td>1</td>
</tr>
<tr>
<td>classical civilisations</td>
<td>1</td>
</tr>
<tr>
<td>classical greek</td>
<td>1</td>
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<tr>
<td>classical greek greek</td>
<td>1</td>
</tr>
<tr>
<td>classical studies</td>
<td>1</td>
</tr>
<tr>
<td>classical studies studies</td>
<td>1</td>
</tr>
</tbody>
</table>
This pattern can be found however we analyse the search logs

- Across audiences
- When narrowed by theme: for example, within a particular subject
- Over time: themes persist from month to month
- Across internal and external search engines

Designing for Search

Designing a good search
In a 1997 paper, Ben Shneiderman offered these guidelines for search

- 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

Don’t they sound like general guidelines for good design?

Design Recommendations

- Make search visible
- Help users ask a question easily.
- Make results meaningful
- Make search smart
- Make it a conversation
Designing for Search

Make search visible:

Finding the search feature

Finding the search box

- Users look for search at the top of the page
- Clutter around the box or being hidden in the header decoration could make it hard to see
Two search boxes on a page can be a usability problem, unless they are clearly defined

Text entry boxes have a strong “attraction” and users will type in any field that is not clearly defined

Advanced search features on the home page (or in the banner) are wasted effort

Why? Because no one will try them until they have tried the simple search first.

This may not be true if there is a strong audience of “insider experts”
“Search” may be a series of selections

- Behind the scenes, a search by a classification scheme

Make search visible

- Put a simple entry box on the home page, in a visible position
- Keep search in a standard location
- Avoid clutter with options and other distractions
- Consider “hiding” search behind smart links
Help users ask a question easily

It is hard to be specific enough for a machine to interpret what we say

- Words can have specialized meanings
  - “Old House” is a renovator’s term, and has special meaning
- Words can have double meanings
  - “Dinosaur” can be a prehistoric beast or a metaphor for someone whose time has passed

http://www.ucomics.com/adamathome
May 19, 1999
Putting a question into words is hard for users, especially with difficult terminology

- They try to guess the correct type of language to use
- They get “stuck” on specific words and have trouble thinking of other terminology
- They try to be “precise” or to think “the way the computer does”

… and they recognize the problem

Even relatively experienced searchers expressed frustration about choosing search terms

Constructing complex expressions is hard

- Boolean logic is backwards from everyday speech:
  
  AND limits (ALL)
  OR expands (ANY)

- Selecting from a list is easier.

Users assume that checkboxes mean ANY
People use suggestions when they are offered

- They let users know what is available and support recognition over recall
- They have quickly shifted from a “new feature” to something expected.

We’re starting to see users refine their search, by adding words, or using helpers

- Looking for “what is the best treatment for breast cancer?” on Google, one participant tried the search three times, each time getting more specific:

  - Treatment
  - Cancer treatment
  - Breast cancer treatment
Help users enter questions easily

- Offer suggestions for spelling correction
- Search for similar words or synonyms
- Offer selection instead of typed entry

Designing for Search

Make the results meaningful
Search results must be easy to scan

- Search results pages are a variation of any menu page where visitors “scan, select and move on.”

The Open University

Frequent and new visitors have different reading patterns.

Students: focused and purposeful, using options and special functions

Enquirers: more diffuse as they learn the page

The Open University
People treat the search results page like any other menu page

- They rely on “headlines” to tell them what is in an article
- The abstracts need to convey the difficulty, type and scope of the content
- Sometimes, reading the abstracts gave them the information they needed

….and they count on it to be informative.

We saw many typical search results, but some that were really terrible.

**On the About network:** stress urinary incontinence

What are the types of urinary incontinence? Learn about the symptoms and treatment options. URL: [http://www.about.com/library/weekly/aa071700.htm](http://www.about.com/library/weekly/aa071700.htm) (About Women’s Health)

**Urinary Incontinence Treatment Options for Women**

Medical Treatment options in physical therapy for loss of bladder control and an effective treatment for urinary incontinence. URL: [http://www.physicaltherapy.about.com/library/article viết](http://www.physicaltherapy.about.com/library/article viết)

**Types of Urinary Incontinence in Women**

Types of urinary incontinence that cause loss of bladder control in women. URL: [http://www.physicaltherapy.about.com/library/article viết](http://www.physicaltherapy.about.com/library/article viết) (About Medical News)

It’s No Laughing Matter

New Survey Reveals the Emotional Impact of Incontinence


**Urinary Incontinence in Women: How It Is Diagnosed**

How loss of bladder control and urinary incontinence difficulties are diagnosed. URL: [http://www.physicaltherapy.about.com/library/article viết](http://www.physicaltherapy.about.com/library/article viết) (About Medical News)

All About Urinary Incontinence - New Health - News M.M. 7/2011

**Articles matching “bladder”:**

glossary.asp
problems.asp
print_problems.asp
doctor.asp
print_doctor.asp
basics.asp
expect.asp
print_expect.asp
basics.asp
doctor not alone.asp
print basics.asp
doctor conversation.asp
new.asp
helping.asp
helping.asp
Everyone assumed that the most important items are at the top of the results list

Results for: incontinence

153 results found, sorted by relevance

THE MERCK MANUAL, Sec. 17, Ch. 215, Urinary Incontinence
Transient incontinence is uncommon in younger persons but common in the elderly, in whom it should always be considered. It requires

THE MERCK MANUAL, Sec. 17, Ch. 215, Urinary Incontinence
Urinary incontinence is abnormal regardless of age, mobility, mental status, or frailty. Incontinent persons are frequently embarrassed ...

THE MERCK MANUAL OF GERIATRICS, Sec. 12, Ch. 99, Urinary Incontinence
Incontinence
Eight to 34% of community-dwelling elderly persons suffer from urinary incontinence, rates are higher in women than in men, and urinary ...

THE MERCK MANUAL OF GERIATRICS, Sec. 13, Ch. 110, Constipation, Diarrhea, and Fecal ... Constipation is the most common gastrointestinal problem among adults ...

Headline words count heavily in setting apparent priority

To design pages for search, write the titles like headlines

People only read the description if the title is promising

Bon départ: beginners’ French – Open University course
...Open University online prospectus; Courses & Qualifications – L211 Bon départ: beginners’ French, Bon départ is the first course in the University's...

Nouvel envoi: upper intermediate French – Open University course
...Open University online prospectus; Courses & Qualifications – L211 Nouvel envoi: upper intermediate French, Envoi is the first course in the...
Too many features on the search results page can confuse instead of supporting users

“Too many features on the search results page can confuse instead of supporting users”

Another example of a confusing search results page

“Another example of a confusing search results page”
Search again options can be tricky to implement well.

- When they are too complicated – or don’t seem relevant, they are ignored.

Make results meaningful

- Create informative link titles
- Make descriptions short, but informative
- List results in priority - relevance order
- Don’t clutter results so that the list is hard to see
Make search smart

People are starting to expect smart features that help them search better

- Recommendations for “best bets” (and make them sticky at the top of the list)
- Suggestions for additional ideas for search
- Cluster results for semantic meaning
- Personalize the search based on history
Make suggestions based on knowledge of how people search

- Which is more usable?

Clustering can be useful, but must be done well.
Clustering relies on users understanding the categories

Special searches can be tailored
The problem with federated search is that it is usually based on servers, not content.

Recommendation engines mix crowd-sourcing with personal ratings or past history.
Make search smart

- Use search engine features to help with misspellings and synonyms
- Provide recommended links when appropriate
- Suggest good search terms and examples
- Use metatags to customize search

Designing for Search

Make it a conversation
Tagging on blogs allows users to connect chunks of information.

- Folksonomies allow users to add their own tagging.

This interface allows users to decide how many fields they want to see.

www.cancer.gov/clinicaltrials
Users make assumptions about the scope of the search based on their path through the site

- “Of course I know it’s a machine, but you do want it to know…”
- “You ask for one thing, and you get all of this.”
- “We’re already in ‘stroke.’ Will that stay, or will I have to add it…”

This search combines results and query on one screen

“Where can I find a house?”

Direct manipulation to form a query
- Visual representation of results
- Rapid, incremental, and reversible actions
- Immediate and continuous display of results

Developed at the HCIL of University of Maryland
http://www.cs.umd.edu/hcil
Google maps and other mashups let users ask follow-up questions easily

Social networks rely on an implicit search, based on tags or location
Tag clouds: some love them, some hate them, some think they are just decoration

- What do the items in the cloud represent?
  - Recent use
  - Frequent use
  - Most people using
  - Most hits

What happens when the list of tags gets very long?
Make it a conversation

- Maintain context of page or section, especially on large sites
- Identify different types of content clearly
- Create ways for search to interact with other dynamic data
- Make it easy to dynamically interact with the query and the results

Designing for Search

You can’t design good search results until you understand the goals of search for your site
Let’s brainstorm

- What are some of the goals you might have for search on your site?

One model for thinking about how search works within a site

<table>
<thead>
<tr>
<th><strong>Focused site</strong></th>
<th><strong>Deep site</strong></th>
<th><strong>Broad site</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Single narrow topic</td>
<td>Single, broader topic</td>
<td>Multiple topics</td>
</tr>
<tr>
<td>Limited number of pages</td>
<td>May have many pages</td>
<td>May be organized into “subsites”</td>
</tr>
<tr>
<td>Single primary audience</td>
<td>Several audiences</td>
<td>Large number of pages</td>
</tr>
<tr>
<td>Search helps locate specific, detailed topics (but may often have no hits)</td>
<td>Search aids in site navigation</td>
<td>Search narrows the world to a section where the visitor can explore</td>
</tr>
<tr>
<td>Expands the site by providing a way to link to other sites that have appropriate material</td>
<td>Exposes all of the site content on a specific topic, cutting across the menu hierarchy</td>
<td>Search makes connections between sections or topics on the site</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Whitney Quesenbery | whitneyq@WQusability.com | www.WQusability.com
We compared 4 different search engines to see how useful their results were

Case study: The Open University

<table>
<thead>
<tr>
<th>Overall Success Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search 1</td>
</tr>
<tr>
<td>Search 2</td>
</tr>
<tr>
<td>Search 3</td>
</tr>
<tr>
<td>Search 4</td>
</tr>
</tbody>
</table>

- Searched on each for the top 25 terms from the search logs
- Graded the results on a +3 to -3 scale
- Toted the scores

Good search results showed the breadth and depth of the OU content

Your search for french produced the following results:

OU courses & qualifications (online prospectus) (290)
OpenLearn (freely available course materials) (709)
Other OU content (1639)

<table>
<thead>
<tr>
<th>Language courses</th>
<th>OpenLearn</th>
<th>Other OU content</th>
</tr>
</thead>
</table>
| French, German, Spanish - New to the OU - The Open University | ![ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ 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Poor results had just one type of page, and repeated hits.

Another example of search results

Results for: screening for colon cancer

Best Bets for Colorectal Cancer Screening

Cancer Trends Progress Report Colorectal Cancer Screening

This section of the Cancer Trends Progress Report focuses on the use of the fecal occult blood test (FOBT) and colorectal endoscopy (sigmoidoscopy or colonoscopy).

Results 1-10 of 1457 for: screening for colon cancer

Colorectal Cancer (FOBT), Treatment (Health Professional)

Expert-reviewed information summary about the treatment of colon cancer

Abstracts of Approved Projects

In addition, tumor DNA from the cases will be examined for promoter hypermethylation at specific candidate genes including Page 3 NATIONAL CANCER INSTITUTE COLON-CANCER FAMILY REGISTRY ABSTRACTS OF APPROVED PROJECTS (8:19:2007) NLH, APC, and M09R. http://www.cancer.gov/nccirpnp/a070001/abstracts.pdf

Microsoft Word - Final Signed Redac Minutes February 7 2008 email version.doc

VIII. Cancer Stem Cells—Erie, M. Wallace and Jonathan Vogel

Delegations of Authority—Dr. Paullette Se. Grav... 13 X. Review of Program Project Grant Applications—Mrs. Diane Brevort and [X].

Vermont State Cancer Plan, December 2005


Cancer Prevention Overview (PDQ), Health Professional
An important part of the analysis is understanding how search supports traffic.
Usability evaluation of search interfaces

Evaluating search requires meaningful tasks, something to search and interaction

- You can affect how people search by how you phrase the task.
  - If you want all participants to do the same tasks, phrase them carefully.
  - Consider working with participants to construct their own tasks
- You can test static search forms and search results, but it is not the same as the dynamic interaction of search.
Support for searching has to be embedded into all aspects of the design

- Understand, and design for, popular searches
- Make search results more useful
- Improve the “searchability” of content pages
- Help make connections between content

Whitney Quesenbery
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Twitter @whitneyq and @plain_language

- Past-president UPA
- Fellow of the Society for Technical Communication
- Served on two US government standards advisory committees: voting systems and accessibility.
Collaborators

- The Open University: Caroline Jarrett (Effortmark), Ian Roddis, Viki Stirling, Sarah Allen
- Lilly Women’s Health: Christy Mylks, Debbie Kauffman
- NCI Clinical Trials Search: Colleen Ryan, Sandra Saperstein, Nancy Atkinson, Holly Massett, Christy Mylks
- NCI user research: Lynn Baumeister, Holly Massett, Christy Mylks, Silvia Inez Salazar, Jessica Rowden

Resources

- Marti Hearst, Search User Interfaces Oxford University Press.  
  http://searchuserinterfaces.com/book

- Marcia Bates “The Design of Browsing and Berrypicking Techniques for the Online Search Interface”, online, 1999  
  http://www.gseis.ucla.edu/faculty/bates/berrypicking.html

- Ben Shneiderman, “Dynamic queries, starfield displays, and the path to Spotfire”, 1999  
  http://www.cs.umd.edu/hcil/spotfire/