Matching Search Technology to User Expectations: Opportunities to improve medical search interfaces

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October 2006

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The Task

Title: *"Matching Search Technology to User Expectations: Identification and Evaluation of End-user Behavioral Patterns when Accessing and Retrieving Health Information via the Web*

Purpose: *"To document persona profiles of various health professionals, define basic search scenarios, derive user sense-making and heuristic decision models and describe how some current and potential NLM Web site users obtain, review, and employ on-line medical information. Translate findings into interface design and recommendations."*

2

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Outline

○ Why is Search an Issue?
○ Activities Map
○ Literature Review: Assessing what we Know and Don't Know
○ Medical Literacy and Cognitive Obscuration
○ Interview Participants: Persona's and Scenarios
○ Filters and Organizing Schemes
○ Sense making (Search over time)
○ Search Definitions and Types of Search
○ Models of Searching as sources of design requirements
○ Focus Group Findings
○ Some Conclusions

3

The Problem Statement

- What are the usability criteria for search engine selection?
- Ever increasing amounts of information compete for user attention
- Rapidly changing and evolving content for Medical and Health Information proliferates on Web sites
- Highly technical language is used
- Scientifically proven knowledge is complex and people avoid complexity
- The information is there but people don't access it or can't find it
- Do users know what they are looking for?
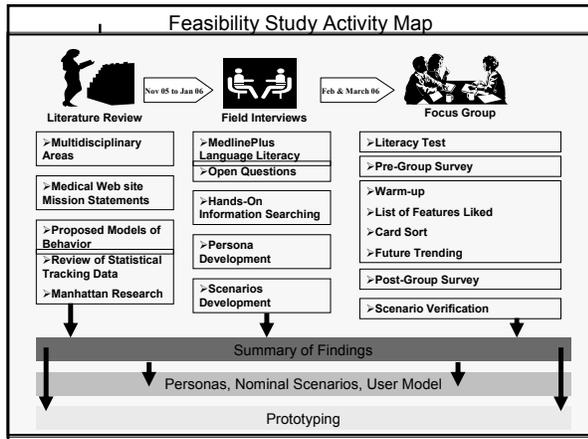- How do users know when they are "done"?

4

Feasibility Study Activity Map

Literature Review → Nov 05 to Jan 06 → **Field Interviews** → Feb & March 06 → **Focus Group**

Literature Review	Field Interviews	Focus Group
➢Multidisciplinary Areas	➢MedlinePlus Language Literacy ➢Open Questions	➢Literacy Test
		➢Pre-Group Survey
➢Medical Web site Mission Statements	➢Hands-On Information Searching	➢Warm-up
		➢List of Features Liked
➢Proposed Models of Behavior	➢Persona Development	➢Card Sort
➢Review of Statistical Tracking Data		➢Future Trending
➢Manhattan Research	➢Scenarios Development	➢Post-Group Survey
		➢Scenario Verification

Summary of Findings

Personas, Nominal Scenarios, User Model

Prototyping

Medical Literacy

- What We Know:
  - Many people are unable to find and understand information that is intended for them and could benefit their health
  - The primary sources for Medical Knowledge are Television, Magazines, Relatives and Friends
  - When people seek a Medical Website they use WebMD or Association Sites
  - People misspell and misread medical and drug terms
  - Women more than men communicate medical information
  - Older people demographically have more need for medical information look-up but younger populations are more practiced in the use of Web based technologies

- What We Don't Know:
  - How medically literate are NLM's prototypical Web site users?
  - How people acquire what knowledge from Web sites
  - What types of information people are looking for
  - Why people don't get to the information intended for them

6

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From Medical Literacy to NLM Website: Medline Plus Literacy

Medical Literacy Test (Pilot and Health Care Interviewees):

METHOD: Two HF specialists randomly collected "medical terms" from NLM's MedlinePlus Web site (Up to 3 levels deep.)
THEIR TASK: Each selected 5 words of similar judged difficulty and belonging to different "aspects" of the medical domain. Terms found were rank-ordered with respect to perceived complexity with an inter-rater agreement coefficient near 1.
TERMS: 30 terms were presented in rank-ordered form from easiest to most difficult.

INSTRUCTIONS: Participants in interviews were asked to indicate (checkmark) all those terms on the list that they were familiar with to the extent that they could explain the terms' meaning to someone else. (!)They did not <u>actually</u> have to define the meaning)

Results:
All Participants had some level of medical knowledge.
They marked only about half of the items on the list as words or terminology that they could explain to someone else.

7

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Terms Used In Our NLM Web-Sourced Literacy Test:
Easy - Low Level Literacy Terms

Instructions: Please place a check mark against all of the following lists of words from top to bottom that you believe you know the meaning of and could explain to a third party:

Level	Term	College 2nd Year	BS NW	BS	MS ESL	MS NW
Easy	Exercise	X	X	X	X	X
	Bone	X	X	X	X	X
	Eyes and Vision	X	X	X	X	X
	Stomach	X	X	X	X	X
	Heart	X	X	X	X	X
	Heartburn		X	X	X	X
	Depression	X	X		X	X
	Birth Defect	X	X	X	X	X
	Antacid	X	X		X	X
	Gene	X	X	X	X	X

8

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Medium Difficulty –
Moderate Level Literacy Terms

Level	Term	College 2nd Year	BS NW	BS	MS ESL	MS NW
Medium	Reflux	X	X		X	X
	Valve	X	X		X	X
	Ulcer	X	X		X	X
	Phobia	X	X	X	X	X
	Metabolism	X	X	X	X	X
	Osteoporosis	X	X	X	X	X
	Mutation	X	X	X	X	X
	Myopia	X	X	X	X	X
	Colitis					
	Hemophilia			X	X	

9

Difficult - High Level Literacy Terms

Level	Term	College 2nd Year	BS NW	BS	MS ESL	MS NW
Hard	Sphincter			X	X	X
	Gastroesophragial		X		X	
	Autosomal Dominant					
	Leukodistrophy					
	Keratotomy					
	Squamous					
	NSAID					
	Sucralfate					
	Ibandronate					
	Hemachromotosis					

10

Implication: Roughly half of the medical terminology that is shown on the MedlinePlus Web site is **NOT** familiar to people with a college degree.

11

Literacy is a HUGE issue:
Typically only half of this NLM Website can be "understood" by average educated users.

12

Slide 1

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Cognitive Obscuration:
Example of what a user "sees" / understands

[ ] Items not known/understood hence ignored are shown masked

United States
National Library of Medicine
National Institutes of Health

Search NLM Web Site
[   ] [Go]

Search Term(s): CLL   [Search] Help

Search results for "CLL"

Search results found in:
- **National Library of Medicine** (43)
- **Health Information** MedlinePlus (198)
-   Profiles in Science (7)
- **Exhibits** (4)
- **Archives** (0)
-   Comm. on Systemic Interoperability (0)

From National Library of Medicine

http://www.nlm.nih.gov/mesh/indexingmanual/21_21.htm

(TECHNICAL MEMORANDUM) cell lymphoma)
http://www.nlm.nih.gov/mesh/indexingmanual/TM_419.htm

http://www.nlm.nih.gov/mesh/indexingmanual/28_16.htm

http://www.nlm.nih.gov/mesh/indexingmanual/25_30.htm

FUNDAMENTAL CONCEPTS
http://www.nlm.nih.gov/nichsr/hta101/ta10108.html

Toxicology Tutor
http://sis.nlm.nih.gov/enviro/toxtutor/tox1gloss.html

United Medical Language Systems (UMLS®)   Basics

13

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Measured Health Care Professional Literacy

(only a few more terms understood than the general educated public)

Phobia	100%
Metabolism	90%
Osteoporosis	100%
Mutation	80%
Myopia	60%
Colitis	80%
Hemophilia	80%
Sphincter	80%
Gastroesophragial	30%
Autosomal Dominant	60%
Leukodistrophy	10%
Keratotomy	30%
Squamous	60%
NSAID	80%
Sucralfate	40%
Ibandronate	0%
Hemachromotosis	30%

14

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General Recommendations for:
Improving Web Site "Language"

- o Avoid Abbreviations of all kinds
- o Provide a Medical Dictionary for quick look-up of unknown terms
- o Avoid displaying long strings of URL page names (Computer Literacy)
- o Don't display meaningless values (numbers that have no meaning to the casual visitor)
- o Don't prominently display program-centric material not of interest to main purpose users (i.e. "Comm. Systematic Interoperability"
- o When providing menu choices for navigation they should be in the expected standard location (roughly left or upper center of a page - non interfering with search box)
- o When viewing search results – most people read the center list of items (first few) only and didn't pay attention to the surrounding headers or other information

15

Filters and Organizing Schemes

Some Findings from Interview Participants:
o Any user search typically starts with Google!
o The Benchmark: the entire search experience needs to be shorter in duration than the time it would take to look up info in a reference book. (Medline plus should be available as a toolbar search)
o Content Access could be organized by role of the user (separate area for physicians, nurses, researchers versus lay people; general educational materials versus case study professional articles and content)
o Always provide a topic preview summary describing what the content entails
o Mark applicable content "Easy Read" or "Professional" to guide people
o Mark content with original language (if the article is in Chinese) indicate this in the English language abstract reference
o On Medline Plus, participants avoided going to areas that have large numbers (of hits) associated with them – they will go to the smaller sets first.
o Show all video and alternate media materials together in a "multi-media" room for broadband access.
o Provide FAQ –like (what to ask) topics about diseases, drugs, treatments
o Provide "blog"- like content by medical experts discussing major current topics
o Provide links to on-line educational multi-week "courses" and give CEU credits.

16

From Organizing Schemes to User Sense making

Some Findings from Interview Participants:

o User Search is contextual
o Users either have fairly specific goals – they want to go to something again
o Or, they are engaged in some larger educational purpose – want to learn about
o Web sites need to address user goals on the entry page (! see next) and every other page
o Users are willing to explore and are "waiting for suggestions" from an expert or a "certified" organization
o Google and WebMD are successful because they tell people where they might want to go, what to do next
o Never have zero results on any search query without directing the user to a different area
o In general, enable people to go from general to more specific knowledge without backtracking or re-directing them
o Users look for "real" news (anything new that requires updating of existing knowledge is of interest to professional health care providers)
o Both medical search novices (general population) and research experts repeat their searches over time.
o Allow people to "manipulate" knowledge elements (shopping basket – book case metaphors)

17

Are User Goals Addressed?
Yes but....

• Control and Prevention

• Science-based Content on a Special Condition

• Insider Information (Medicine by Role)

• Information useful for Parents

18

Slide 19

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Sample Persona – Information Service Provider Looking for Health / Wellness Info

PERSONA - Disabled General Information User

Background
Mr. RH is a 35 Year-old, US born, para- and quadriplegic male who is the Executive Director of an Accessibility Guide published for disabled persons residing and working in the Washington, DC metro area. He is in good health, but very conscious of the importance of exercise for people in his situation.

He uses a laptop computer extensively every day for his work, and although manually -challenged, does not use any special accessibility devices or programs.

Sources of Information
Outside of his daily working routine, Mr. RH is usually looking for general information on health and exercise for the disabled. He may also look up specific disabilities he is unfamiliar with when a disabled person phones or e-mails him seeking advice.

Internet Experience
Mr. RH uses the Internet for work and has also bought products online using Amazon and e-Bay. He prefers using the bigger commercial sites as they are quicker to respond and easier to use.

Medical Web Sites
He feels that medical sites are generally too technical for the average user and prefers to use Google for most of his searches. His other top Web sites to visit for searching are NCPAD (The National Center on Physical Activity & Disability), WebMD and About.com .

Medical Search Experience
○ In terms of searching for medical information, Mr. RH's past experience is extensive but narrow. He is looking for health and exercise related information for paraplegics. This gives him wide knowledge on the main areas of the body relevant to his disabilities. However, he has also to be aware of a wider range of disabilities for enquiries to his guide.
○ His main strategy for searching is to use Google to find the most up-to-date links in his own knowledge area. He uses WebMD for information on unfamiliar disabilities.
○ When doing his own search using the key-words exercise/health/paraplegic on NCPAD he got "two good results". He was pleased that these were new items of information.
○ He feels that Google could do with summaries rather than just showing the words searched for highlighted. It would also benefit from a "word" catcher to show exactly where in a link the words looked for are situated – often buried.

19

Slide 20

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Exercising this Persona:

Search results for "exercise and health and paraplegic"
on Google versus MedlinePlus

On MedlinePlus: 3 Items on Spinal Cord Injuries, 1 Item on Muscle Function Loss, 0 Items on Other, 0 Items on News

20

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Searching - Definitions

○ **One Definition:**
  ● **The act and process of locating information in various sources, for example, looking for a book in a library catalog, looking for articles in databases, or looking for information on the World Wide Web.**
  ublib.buffalo.edu/libraries/help/glossary.html

○ **Keyword searching**
○ **Boolean searching**
○ **Field searching**
○ **Phrase searching**
○ **Online searching**
○ **Concept searching**
○ **Word searching**

21

Three "Nominal" Search Scenarios found in Study

Search Domain Levels

The Look-Up
The Find-Out More
The What's New

22

Search Scenario (1): The Look-up

The Look-up Scenario:
Find out what a particular disease name or abbreviation means.

What is xxx?
Start

Recall Word

Pick First in List or
Compare Item Features

1
Type Known Term in
Search Box

2
Read Results List

Inspect and Compare Words

Decide if goal is reached
Go back if desired

Apply Selection
Heuristics –
hypothesize about
underlying
content

3
Select and click
an Item

4
Read Definition

End

23

Search Scenario (2) : Find out More

The Find-out-More Scenario:
Find out information about a newly diagnosed condition for a friend.

Start

Summarize Friend's Verbal Report
Decide on Approximate Task Length

Compare Items

Surface Heuristics:
Language Level
General – Specific
Expected Length
Reputable Source

1
Type a Term in Google
Search Box

2
Read Results List

Compare Range of Items

Decision: does material match expected
summary / introduction to - form?

Apply Selection
Heuristics:
Want Overview
Summary
Info to Know
Questions to Ask

3
Select and click
an Item

Iterate

4
Read – Browse a
couple of content items

Decision Heuristic: Is
this new to me? Will
this have everything
we need to know?

5
Explore links
given

Select Information
for Sharing / Referral

6
Print, E-mail,
Note URL
Reference

End

24

Search Scenario (3):
The What's-New Scenario -
Repeated Searching/Learning

Find out information over time, follow authors, stay "plugged-in".

Start

Expert Knowledge –want detailed articles with all the specifics to judge

1 Type a Term in Google Search Box

Compare Items

Surface Heuristics:
Date
Author
Title
Abstract
Is full text available?

2 Read Results List

Apply Selection Heuristics:
Affiliation of Authors
Implied specificity
Is this new to me?

3 Select and click an Item

Iterate

Decision: Paid versus free resources

4 Quick Read Abstract for desired "Specifics"

Decision Heuristic:
Take time to read?

5 Click Item

Select Information for Highlight/Storage

Subscribe to Notification

6 Print, E-mail, Copy Reference, Subscribe for Updates, Store

End

25

Characteristics of Search Scenarios

Search Scenario	Characteristics	Search Term Support
Look-up	One-Time Throw-away	Exact Match or Thesaurus of Terms Needed
Find-Out-More (Sense-making)	Elaborated Search for Resource Materials	Spiraled Knowledge (marking, transferring)
What's New (Longitudinal Searching)	Repeated Searching for Added Info	Integrating Knowledge (using)

Reach-Out Searching = Discovery Searching – some experts & other explorers use Google for this 4th search type - "Boldly go where I would otherwise not go".

26

User Search Modeled

Activity Time

Level of Content Detail

Find-Out-More Search (Scenario 2)

Group of Matches

Simple Look-up Search (Scenario 1)

Individual Match

Data Cluster

What's New Search (Scenario 3)

Data Item

browse   search   select   filter   evaluate   backtrack   match   update

Individual Criterion

Group of Criteria

Cognitive Activity

27   Adapted from: Anonymous Proposal Review – "Tracking Cognitive Strategies" - to be published in 2006 HFES Proceedings

General Conclusions About Study Methods

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- o Individual Interviews worked very well
  - Types of Searching (Personas, Scenarios, Models)
  - Catalogue of Competing Sites Visited
  - Actually Observing On-line Search Behavior
  - Pinpointing search difficulties
- o Focus Group worked well for
  - Generating specific need examples
  - Survey Questions detail (pre- and post)

28

Some General Search Study Conclusions

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- o **Medical Sites are not necessarily the favorite first choice when searching**
- o **A key issue is validity of information**
- o **The most up-to-date information is generally preferred**
- o **International links (and particularly foreign language documents) were generally dismissed**
- o **Distrust of both commercial and government sites was pretty equal**
- o **Search features/ utilities were criticized for many reasons**
- o **Seen as unnecessary and superfluous additions to sites**
- o **Lack of help in searching**
- o **Users did very little to preserve search results**
- o **There was a general lack of knowledge on some of the many NIH –related sites**

29

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The End

Thank You - QUESTIONS?

30