What are they thinking?
Searching for the mind of the searcher

Daniel M. Russell
September 17, 2007
[ jaguar ]
[ iraq ]
[ latest release Thinkpad drivers touchpad ]
[ ebay ]
[ first ]
[ google ]
[ brittttteny spirs ]
• How can we figure out what you’re trying to do?

• The information signal is sometimes weak…
• ~60% users have an average of less 1 query/day

• Average query length is ~3 words / query

• Average visit length is very short (~3 mins)
### Confidence among Searchers

*The more confident the searcher, the more engaged he is with searching.*

<table>
<thead>
<tr>
<th></th>
<th>Very Confident</th>
<th>Somewhat Confident</th>
<th>Not Confident</th>
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<tbody>
<tr>
<td>Frequency of searching</td>
<td>%</td>
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<td>16</td>
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</table>

92% say they're confident in their searching ability. While 66% search less than 1 time per day.

<table>
<thead>
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<td><strong>Successful Searching</strong></td>
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<td>Always</td>
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<td>Rarely</td>
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<td><strong>Importance of most searches</strong></td>
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</table>

Pew Internet & American Life Project (2005) ±3%
What are they doing?
Quantum ESP experiment
So this is celebrity with most Oscars…
Actor… ah… most…
I’m just going to try that…most Oscars…
don’t know…
(reading) “News results for ‘actors most Oscars’ … “
huh..
Oh, then that would be currently
“Brokeback”… “prior voices”… “truth in
Oscar’s relevance”…
…now I know…
… you get a lot of weird things..hold on…
“Are Filipinos ready for gay flicks?”
How does that have to do with what
I just….did…?
Ummm…
So that’s where you can get surprised…
you’re like, where is this… how does
this relate…umm…
Bond…I would think…
So I don’t know, it’s interesting…
Dan: Did you realize you were in
the News section?
Oh, no I didn’t. How did I get that? …
Oooh… no I didn’t.
How to be literate user of a UI?

• How does one make sense of a user interface?
• What do you pay attention to?
  – What’s interactive? What’s live?
  – What do various actions do?
  – What model does user have of UI?
  – Groups / Functions / Overall operation / Gestalt
What do you notice?
Inattentional Blindness (Cognitive Psychology)
by Arieh Mack, Irv Rock, Irven Rock

List Price: $50.00
Price: $60.00 & This item ships for FREE with Super Saver Shipping.
See details.

Availability: Usually ships within 24 hours

Used & new from $51.66

Edition: Hardcover | All Editions

See more product details

Great Buy
Buy this book with The Attentive Brain by Raja Parasuraman (Editor) today!
Buy Together Today: $102.00
Buy both now!

Customers who bought this book also bought:
- The Attentive Brain by Raja Parasuraman (Editor) (Hardcover)
Please review and submit your order
Your default shipping address and other settings are shown below. Use the buttons to make any changes; when you’re done, click the “Place your order” button. By placing your order, you agree to Amazon.com’s privacy notice and conditions of use.

Important Message
Want free shipping? Make sure you select FREE Super Saver Shipping as your shipping speed under “Shipping Options” below. (Note: Orders will take an additional 3 to 5 days to ship. Other restrictions apply.)

Click the "Place your order" button to complete your purchase.

Shipping Details

Shipping to:  Change
Daniel M. Russell
3419 Ramona St
Palo Alto CA 94306
USA

Sending items to more than one address?  Ship to multiple addresses

Shipping Options:  Learn more about shipping prices and policies

Choose a shipping speed:
• FREE Super Saver shipping (5-9 business days)
• Standard Shipping (3-7 business days)
• Two Day Shipping (2 business days)
• One Day Shipping (1 business day)

The following items will arrive in 1 shipment:

Estimated ship date for this item: January 18, 2003 - January 20, 2003

Order Summary

| Item(s) | $60.00 |
| Shipping & Handling | $3.99 |
| Total Before Tax | $63.99 |
| Estimated Tax | $0.00 |
| **Order Total:** | **$63.99**

Why didn’t I qualify for free shipping on my entire order?

Have a gift certificate, promotional code or gift card?
Enter them here (one at a time):

Apply

Payment Method:  Change

Mastercard: ***-12347
No matches found.

Please check the Help page to make sure you entered the search string properly.
No matches found.

Please check the Help page to make sure you entered the search string properly.
Inattention & Invisible UI elements

User interface modeling in UML - all 10 versions
... This article examines some of UML's user interface modeling facilities. ... can provide a combination of a book's properties for querying a library database. ...
Cited by 43 - Related Articles - Web Search - BL Direct

[BOOK] Database Design - all 2 versions
GC Wiederhold - 1977 - McGraw-Hill, Inc. New York, NY, USA
Cited by 163 - Related Articles - Web Search - Library Search

[BOOK] Database system concepts - all 2 versions
Cited by 461 - Related Articles - Web Search - Library Search

A digital library for geographically referenced materials - all 6 versions
TR Smith - Computer, 1996 - ieeexplore.ieee.org
... library services; and the ingest facility, for storing and processing data from new holdings. CUI means graphical user interface. ODBC means Open DataBase ...
Cited by 97 - Related Articles - Web Search - BL Direct
Why is chron sort so hard? Compare…

@article{gross96dec,
    title={{Demonstrating the Electronic Cocktail Napkin}},
    author={Gross, M.D. and Do, E.Y.L.},
    journal={ACM Human Factors in Computing–CHI},
    volume={96},
    pages={5--6} }

@article{mueller2005hod,
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    journal={Proc. CHI},
    volume={5},
    pages={1673--1676},
    year={2005} }
So… what do we do?

- How do we understand what people are doing?
- Between inattention and low-signal density…
Multiple views of user behavior

- **3M points-of-view:**
  - Micro: *lowest level details—milliseconds*
  - Meso: *mid-level observations—minutes to days*
  - Macro: *millions of observations—days to months*
WHAT are people doing?

1. **Field studies** *(meso)*
   Getting out to see what reality is

2. **Eyetracking studies** *(micro)*
   Studies in the microscopic

3. **Sessions analysis** *(macro)*
   What are people doing in logs, bring outside behavior back to where we can see the signals
• **Interviews held in situ**…
  – Workplace, home, coffee shop … any place… must be search-place
  – Place + context cueing effects
  – Interested in natural use phenomena (ads, distractions, multiple tasks…)

*How does a search engine work?*
2. Recent searches

2.1. Show me the last search you did. Talk about it. Walk me through what you did.

- 9:26 - Covered biker - go to sig directly.
  - already have profile.
  - Yahoo toolbar.
  - [word role in NBC]
  - Click on 1
  - Nebraska, [word role in NBC]

2.2. Now show me a similar search and talk me through it.

  - not ebay
  - so to amazon, check price.
  - go to amazon.com to look for toy at w.

2.3. Can you show me the most difficult search you’ve done? Talk me through it.

- (see above as example)
Client-side logs: Very detailed recording of behavior keyed to video

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<th>TIME_TO_LOAD</th>
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<td><strong>26.567</strong></td>
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</table>
Sample findings

• **Very uneven level of search skill**
  – Many show at least 1 “deep” skill (advanced search, operator use, URL completion)
  – Nobody was consistently broadly expert at search
  – > 50% said they “wished they knew better how to search”

• **Comfort level is VERY important**
  – Users choose familiar over scary (obviously not all, but many—how many?)

• **Education is accidental**
  – Google users have no good way to learn about Google
What we learn from field studies…

- How people think…
- Mental models
- Qualitative approaches
- Emotional reactions
- Expectations (and violations)
- WHY we’re getting certain behaviors:
  - Example: why are 50% of clicks to Advanced Search page short?
Eyetracking & usability studies at Google

~10-20 / week – typically 3 – 5 observers
- Testing new, specific features of UI

• Typical studies:
  - How users perceive a UI change
  - Eyetracking to get at deeper understanding
So.. Did you notice the FTD official site?

To be honest, I didn’t even look at that. At first I saw “from $20” and $20 is what I was looking for. To be honest, 1800-flowers is what I’m familiar with and why I went there next even though I kind of assumed they wouldn’t have $20 flowers

And you knew they were expensive?

I knew they were expensive but I thought “hey, maybe they’ve got some flowers for under $20 here…”

But you didn’t notice the FTD?

No I didn’t, actually… that’s really funny.
Rapidly scanning the results

Note scan pattern:

Page 3:  
1. Result 1
2. Result 2
3. Result 3
4. Result 4
5. Result 3
6. Result 2
7. Result 4
8. Result 5
9. Result 6

Q: Why do this?  
A: What’s learned later influences judgment of earlier content.
Skill of reading a SERP (search engine results page)

- How many results are viewed before clicking?
- Do users select the first relevant-looking result they see?
- How much time is spent viewing results page?
How do users behave in search?

- **Experiment conducted at Cornell**  [Gay, Granka, et al., 2004]
- **Users:**
  - Searched freely with any queries
  - Script removed all ad content
  - 5 info & 5 nav tasks given to participants
- **Subjects (Phase I)**
  - 36 undergraduate students
  - Familiar with Google
How many links do users view?

Total number of abstracts viewed per page

Mean: 3.07    Median/Mode: 2.00

Dip after page break
Looking vs. Clicking

- Users view results one and two more often / thoroughly
- Users click most frequently on result one
Which results are viewed before clicking?

- Users typically do not look at lower results before they click (except maybe the next result)
Strong implicit behavior...

- Users **strongly** believe that the search engine rank order matters... and that we have the order right!
Macro: Understanding the behavior of the many

- We have a lot of data: many GB weekly in logs
- How to analyze it?
A typical (long) session

31: Google Search [irish lotto] (4s)
33: Google Result 1 www.lotto.ie/ (7s)
34: Google Result 1 www.lotto.ie/ (4s) (DUPE) (p=31)
36: Nav (back/fwd) www.google.com/search (1s)
37: Google Result 2 www.irishlotto.net/ (2s) (p=31)
39: Nav (back/fwd) www.google.com/search (1s)
40: Google Result 3 www.irishlotto.net/main-results/2005.htm (1s) (p=31)
42: Nav (back/fwd) www.google.com/search (0s)
43: Google Result 4 www.irish-lottery.net/ (4s) (p=31)
44: Google Result 4 www.irish-lottery.net/ (5s) (DUPE) (p=31)
45: Google Result 4 www.irish-lottery.net/ (3s) (DUPE) (p=31)
48: Nav (back/fwd) www.google.com/search (6s)
49: Google Result 8 www.interlotto.com/irish/ (6s) (p=31)
51: Nav (back/fwd) www.google.com/search (1s)
52: Google Result 9 lottery.loquax.co.uk/irish-lottery.htm (21s) (p=31)
54: Nav casino.loquax.co.uk/ (29s)
55: Nav casino.loquax.co.uk/offers/173/Virgin-Casino.htm (4s)
56: Nav (new window) casino.loquax.co.uk/offers/173/Virgin-Casino.htm (0s)
57: Nav (new window) clkuk.tradedoubler.com/click (7s)
58: Nav (back/fwd) casino.loquax.co.uk/ (10s) (p=56)
59: Nav casino.virgingames.com/game/menu.do (15s) (p=57)
60: Nav (back/fwd) lottery.loquax.co.uk/irish-lottery.htm (0s) (p=58)
61: Google Search [irish lotto] (3s) (DUPE) (p=31)
63: Google Result 10 online.casinocity.com/lotteries/irish-lotto/ (11s)
Non-Google actions: “work” from the user’s pov

<table>
<thead>
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<th>No.</th>
<th>Action Description</th>
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<td>Google Result 10 online.casinocity.com/lotteries/irish-lotto/</td>
<td>11s</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Evidence of multitasking

100: Google Search [free roulette] (4s) (DUPE) (p=78)
102: Google Result 7 www.getlyrical.com/general/free_casino_games/free_online_roulette.html (3s)
103: Google Result 7 www.getlyrical.com/general/free_casino_games/free_online_roulette.html (19s) (DUPE) (p=100)

106: Google Result 8 www.saliu.com/Roulette.htm (56s) (p=100)

112: Google Search [shockwave] (4s)
114: Google Result 3 www.shockwave.com/sw/home/ (10s)

117: Google Result 5 sdc.shockwave.com/shockwave/download/download.cgi (16s) (p=112)

120: Google Search [free roulette] (3s) (DUPE) (p=78)
122: Google Result 1 www.ildado.com/free_roulette.html (15s) (DUPE)
124: Google Search [free professional roulette] (2s)
126: Google Search (spell correct) [free professional roulette] (10s)
128: Google Result 3 imagesculptor.com/Roulette/free-roulette-professional-system.php (5s)
129: Google Result 3 imagesculptor.com/Roulette/free-roulette-professional-system.php (8s) (DUPE) (p=126)

133: Google Result 7 www.amazon.com/exec/obidos/tg/detail/-/B0007XRSQ4?v=glance (2s) (p=126)
User: 16925

[ knitting patterns ]

[ knitting patterns socks ]

mining behavior
Kinds of behaviors

- Short / Navigation
- Topic exploration
- Topic switch
- Methodical results exploration
- Query reform

Multitasking

Stacking behavior
Session patterns

- **Search is often a multi-step process:**
  1. find or navigate to a good site ("orienteering")
  2. browse for the answer there

  `[actor most oscars] vs. [oscars]`

- **Teleporting**
  - "I wouldn’t use Google for this, I would just go to…"

- **Triangulation**
  - draw information from multiple sources and interpolate
  
  *Example: “how long can you last without food?”*
Sequence chart

- X over time; event sequence number on Y

![Graph 1](1 query every 24 hrs)

![Graph 2](1 query every 12 hrs)
Light users (over 41 days)
Measurable differences between different task types?

Informational/Directed/Closed
“Find a painting by Georges Seurat called "La Grande Jatte"”

Informational/Locate
“Search for a man’s watch that is water resistant to 100 meters and under $100”

Main effect of task type on:

- **Event count**
  (Kruskal-Wallis: $\chi^2(3)=368.3; p<.001$) and

- **Session time**
  (Kruskal-Wallis: $\chi^2(3)=368.7; p<.001$)

<table>
<thead>
<tr>
<th>Task Type</th>
<th>Event Count</th>
<th>Session Time (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>InfoDC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>InfoU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>List</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Info Direct-Closed < Info Undirected <= List < Locate
To be a strong user...

...you need to have fairly deep knowledge...

- What sites are possible
- What’s in a given site (what’s likely to be there)
- Authority of source / site
- Index structure (time, place, person, …)
  ➔ what kinds of searches?
- How to read a SERP critically
Mental models

• How **DO** people think about what a search engine does?
  
  – Completely keyword search?
  – Full-text indexing?
  – Partial-text indexing?
  – Link anchors?

• What **DOES** one need to know to use search effectively?
  
  – Relevance?
  – Keyword term frequency?
  – Layered index?
  – Spider / crawling?
Fast **Kidney** Stone Relief
www.kidneysite.com All Natural, Safe & Effective Disintegrates
Fast **Kidney** Stone Relief
Urilflow.com Works Immediately To Disintegrate And Flush Out

**Kidney Stones in Adults**
Discusses the causes, symptoms, and diagnosis of kidney stones, strategies and treatment options, as well as information on current.

I want to try one last thing
Mental models 1 (a folksonomy)

1. How does Google look it up? *(how can I say what I want?)*

2. Predictable behavior *(when I do X, it does Y)*

3. What content is indexed? *(what can I search for?)*

4. How are the results ranked? *(why do they come out in this order?)*

5. What’s in the index? *(what are the different kinds of things to find)*
Looking for an image

Froogle? Scholar?

for an image here...
## Many ways to ask about a painting… many ways to respond…

<table>
<thead>
<tr>
<th>Query Terms</th>
<th>OneBox</th>
<th>First Google search result</th>
</tr>
</thead>
<tbody>
<tr>
<td>georges seurat &quot;la grande jatte&quot;</td>
<td>None</td>
<td>The Art Institute of Chicago: Art Access</td>
</tr>
<tr>
<td>georges seurat la grande jatte</td>
<td>None</td>
<td>The Art Institute of Chicago: Art Access</td>
</tr>
<tr>
<td>&quot;la grande jatte&quot;</td>
<td>None</td>
<td>Seurat, A Sunday Afternoon on the Island of La Grande Jatte</td>
</tr>
<tr>
<td>la grand jatte</td>
<td>None</td>
<td>The Art Institute of Chicago: Art Access</td>
</tr>
<tr>
<td>george seurat, la grande jatte</td>
<td>None</td>
<td>WebMuseum: Seurat, Georges</td>
</tr>
<tr>
<td>george seurat &quot;la grande jatte&quot;</td>
<td>None</td>
<td>The Art Institute of Chicago: Art Access</td>
</tr>
<tr>
<td>painting la grand jatte</td>
<td>None</td>
<td>The Art Institute of Chicago: Art Access</td>
</tr>
<tr>
<td>&quot;la grande jatte by georges seurat&quot;</td>
<td>None</td>
<td>Sunday Afternoon on the Island of La Grande Jatte Posters by</td>
</tr>
<tr>
<td>george seurat la grande jatte</td>
<td>None</td>
<td>Webmuseum: Seurat, Georges</td>
</tr>
<tr>
<td>georges seurat painting</td>
<td>None</td>
<td>Webmuseum: Seurat, Georges</td>
</tr>
<tr>
<td>la grande jatte</td>
<td>Image</td>
<td>The Art Institute of Chicago: Art Access</td>
</tr>
<tr>
<td>la grande jatte by georges seurat</td>
<td>Product</td>
<td>The art institute of Chicago</td>
</tr>
<tr>
<td>georges seurat painting grande jatte</td>
<td>Product</td>
<td>Webmuseum: Seurat, Georges</td>
</tr>
<tr>
<td>la grande jatte painting</td>
<td>Product</td>
<td>The Art Institute of Chicago: Art Access</td>
</tr>
<tr>
<td>painting la grand jatte seurat</td>
<td>Product</td>
<td>Seurat, A Sunday afternoon on the island</td>
</tr>
<tr>
<td>seurat la grande jatte pic</td>
<td>Book</td>
<td>FlickrBlog</td>
</tr>
<tr>
<td>la grande jatte by george seurat</td>
<td>Book</td>
<td>Webmuseum: Seurat, Georges</td>
</tr>
<tr>
<td>seurat la grande jatte image</td>
<td>Book</td>
<td>Webmuseum: Seurat, Georges</td>
</tr>
<tr>
<td>La Grande Jatte by Georges Seurat painting</td>
<td>Scholar</td>
<td>The Art Institute of Chicago: Art Access</td>
</tr>
</tbody>
</table>
…with many OneBoxes...
What’s the mental model of oneboxen?

• It’s magic:
  “… I don’t know how to make it come back…”
  “… why does this… thing… keep being at the top?”

• The un-nameable & inconceivable is magical
4. Can you draw a diagram that illustrates how a Google search works? After you enter your keywords, what happens?

Several overlapping concentric circles. No linear, Boolean targets.
Mental model 2
Mental model 3: How can we portray these?

1. Predictable behavior  Can I predict what will happen when I do X?

2. How is content indexed?  Is it full-text? How are images indexed?......

3. How does Google look it up?  Which keywords should I pick?

4. How are the results ranked?  What does the order mean?

5. What’s in the index?  What kinds of documents can I search?
Culture of search 1

- What does it mean to Google something?
  
  “…let me google this on Yahoo…”

- How does always available search change your conversations?
Culture of search 2

• Has ubiquitous search changed expectations about knowledge?

  Type 1: **Eternal verities** (F = ma; Antarctica is a continent)
  Type 2: **Mid-term** (Sacramento is the capital of California; there are 117 elements)
  Type 3: **Ephemera** (my IP address is 9.1.2.142; use Muggle.google.com for your proxy)
Culture of search 3

• Key question: What do you *really* need to know?
  – recognition knowledge?
  – contextual knowledge?
  – search skill?

• When the cost of discovery and access is low… does that change your expectation of others?
A research literacy

- Five kinds of knowledge & skills needed to search:
  - Pure engine technique
  - Domain knowledge
  - Information mapping
  - Search strategy
  - Medical knowledge
  - Plumbing knowledge
  - Reverse dictionary
  - Knowing when to shift between domains
  - Knowing when to stop
  - Moving from wide to narrow
  - Preserving state
  - Knowing when to shift
  - Moving from wide to narrow
  - Preserving state
  - etc...
• A fifth kind of knowledge... assessment / evaluation

Is this believable?
How does this link to other information I already know?
What is the relationship of this information to authoritative sources?
Co-evolution

- **Search engines will continue to change**
  - change is constant…
  - new document types, new searches, new possibilities
  - that’s the point of all our studies / testing
  - things will continue to change rapidly

- **Search engines need to match capabilities with user expectations and understandable user mental models**
  - need to continually refine understanding of user population’s mental models
  - need to detect when a particular model is in play
Shared responsibility

• **For search engines:**
  – To create a system that behaves predictably
  – To understand expectations of entire breadth of users

• **For our users:**
  – To learn the basics of how search engines work
  – To have a functional mental model
END