Cognitive Research for Exploratory Search (CRES)

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CRES project

- Aims to investigate user's behavior and cognitive processes during various information seeking tasks on the Web.
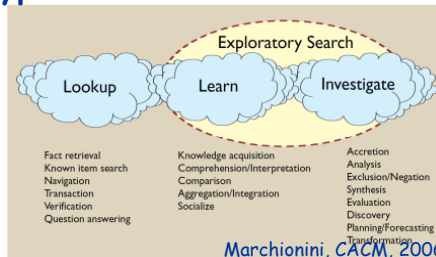
Background

In daily life, users have a lot of things that they want to know, but don't know how to look for them.

- What should I do this coming weekend?
- What is the trial committee system?
- Where can I find a good kindergarten?
- Where can I buy a good car?
- How to write a good project proposal?
- How to plan an enjoyable trip?
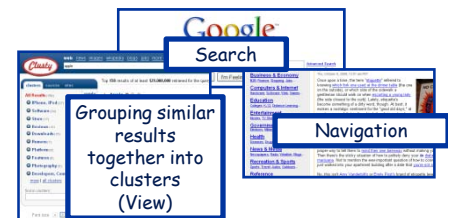- What should be seen at a museum?
- How can I write a good report?
etc.

Types of Information Retrieval

Exploratory Search

Lookup | Learn | Investigate

Fact retrieval | Knowledge acquisition | Accretion
Known item search | Comprehension/Interpretation | Analysis
Navigation | Comparison | Exclusion/Negation
Transaction | Aggregation/Integration | Synthesis
Verification | Socialize | Evaluation
Question answering | | Discovery
| | Planning/Forecasting
| | Transformation

Marchionini, CACM, 2006

Current Search Engines

Search

Grouping similar results together into clusters (View)

Navigation

Research questions:
- How users explore the Web for results from search engines
- What users think when they explore the Web.
   -> Analysis of server-side logs is insufficient.

In depth analysis of user information seeking behavior is indispensable

● Differences between tasks and information needs:
  - Info. gathering for report writing vs. Info. gathering for trip planning
● Type of users (differences of experience):
  - Undergraduates (11) vs. Graduates (5)

Collected data:
· Browsing history Logs
· Screen captured video
· Eye movement
· Thinking aloud
· Interviews, etc…

Procedure

Pre-questionnaires
◆ How much do you use Web weekly?
◆ What browsers do you use?
◆ What search engines do you use?

Instructions
✓You have 15 minutes to collect related information through the Web.
✓Add pages to browser's book marks if useful.

Repeat twice

Search Task
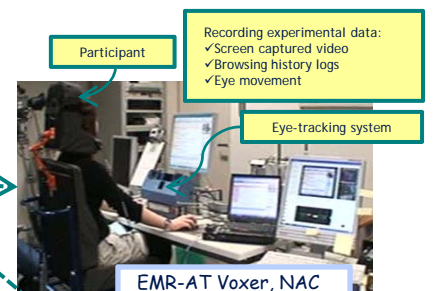Report-writing | Trip-planning
15 min.

Post-questionnaire
◆ How difficult was task?
◆ Satisfied with search results?

Interview
◆ Information-seeking processes
◆ Show screen-captured video

≒30 min.

We proposed analytical frameworks:
"Lookzone": Set of categories indicating which part of resulting pages participants looked at.
"Web action categories": We defined 10 action categories for analyzing a user's behavior on the Web
"Link Depth": How far searchers browse into search engine result pages (SERP).

We developed tools for collecting and analyzing data
"Scanpath2SVG": Visualization tool for eye movement data.
"COPATT": Platform for integrating browsing history logs, screen captured video, eye movement, and annotating users' actions.
"QT-Honey": New client side logging tool based on Lemur Query Log Toolbar (Lemur project).

Recording experimental data:
✓Screen captured video
✓Browsing history logs
✓Eye movement

Participant

Eye-tracking system

EMR-AT Voxer, NAC

T60, Tobii

CRES: Cognitive Research for Exploratory Search (2)

"Lookzones"

	Lookzone	Graduates (n=5)		Undergraduates (n=9)	
		Report Mean(SD)	Trip Mean(SD)	Report Mean(SD)	Trip Mean(SD)
Operation for browser	1 Title bar	3.78 (6.81)	1.00 (1.56)	0.40 (0.80)	0.80 (0.98)
	2 Menu	0.22 (0.42)	0.11 (0.31)	1.80 (3.12)	0.00 (0.00)
	3 Bookmark	4.22 (5.90)	0.00 (0.00)	0.00 (0.00)	0.40 (0.40)
	4 Toolbar	1.33 (1.63)	1.22 (1.40)	0.40 (0.80)	0.40 (0.80)
	5 URL bar	0.56 (1.07)	0.22 (0.42)	0.40 (0.49)	0.00 (0.00)
	6 Search bar	0.00 (0.00)	0.00 (0.00)	6.40 (7.50)	4.00 (7.04)
	7 Search bar button	0.00 (0.00)	0.00 (0.00)	0.40 (0.49)	0.20 (0.40)
	8 Tab	8.11 (9.81)	9.22 (17.94)	12.00 (14.13)	6.00 (6.63)
	12 Scroll bar	0.11 (0.31)	0.00 (0.00)	0.60 (0.80)	0.00 (0.00)
	21 Find in a page	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
	22 Status bar	1.78 (3.39)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Contents areas of SERP	9 Link for services	17.67 (23.44)	5.11 (9.33)	2.40 (2.06)	2.20 (2.14)
	10 Query box	36.89 (36.71)	12.56 (11.93)	5.60 (4.36)	3.00 (4.65)
	11 Search button	0.89 (1.10)	0.67 (0.82)	0.00 (0.00)	0.20 (0.40)
	13 Number of hits	0.44 (0.96)	0.00 (0.00)	0.00 (0.00)	0.60 (0.80)
	14 Sponsor link	6.67 (7.85)	12.44 (9.93)	0.00 (0.00)	11.40 (13.99)
	15 Spell check	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.20 (0.40)
	16 Title	59.67 (38.92)	42.11 (34.19)	41.20 (26.80)	39.20 (40.82)
	17 Snippet	91.11 (55.59)	37.00 (32.84)	74.80 (42.56)	28.40 (28.00)
	18 URL	40.89 (34.27)	15.56 (11.35)	18.00 (9.21)	12.40 (11.83)
	19 Related search	3.00 (4.03)	2.56 (4.11)	1.20 (1.94)	1.20 (1.17)
	20 Link for next page	1.00 (1.89)	0.78 (1.03)	1.00 (1.10)	1.00 (2.00)
Misc	Out of lookzone	52.89 (53.43)	18.89 (14.51)	21.60 (14.47)	17.00 (8.60)
	Lack of eye position	83.44 (73.10)	70.78 (101.06)	15.00 (10.94)	7.20 (4.71)

Graduates tend to use more advanced Web browser features.
e.g. Search bars and tabs. Snippet areas more attractive in Report tasks than Trip tasks.

"COPATT": analysis platform
integrating multiple data types
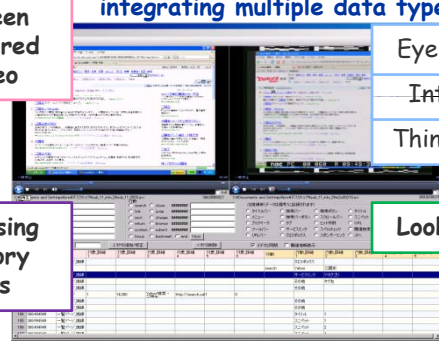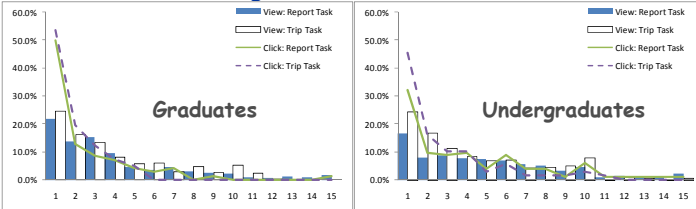

Screen captured video

Browsing history logs

Eye movement

Interviews

Thinking aloud

Lookzones

Eye movement and click ranking
View and click ranking

Graduates

Undergraduates

View: Report Task
View: Trip Task
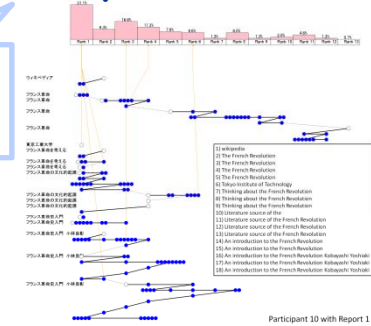Click: Report Task
Click: Trip Task

Users viewed more low-ranking pages for Report tasks than for Trip tasks.
Users' viewing behaviors were heavily influenced by types of queries,
i.e. navigational or informational.

Scanpath2SVG

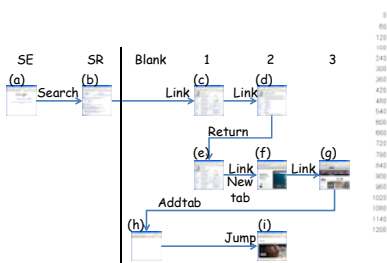**Visualization of viewed page and clickthrough page rankings**

A demo version of Scanpath2SVG visualization is available at http://cres.jpn.org/scanpath2svg/
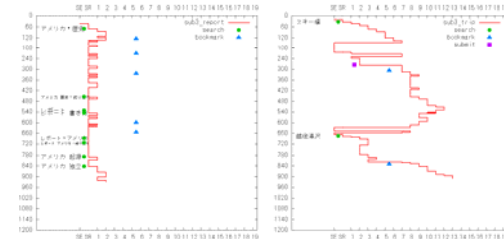
Participant 10 with Report 1

Link Depth Overview
How far users explore the Web

SE SR Blank 1 2 3
(a) Search (b) Link (c) Link (d)
Return
(e) Link (f) Link (g)
New tab
Addtab
(h) Jump (i)

For each task, different strategies are used according to users' Web and task-specific knowledge. Graduates tend to use tabbed browsing strategy for effective information seeking.

Examples of Link Depth
Report writing vs. Trip planning

No. of viewing pages for each Link Depth

Graduates
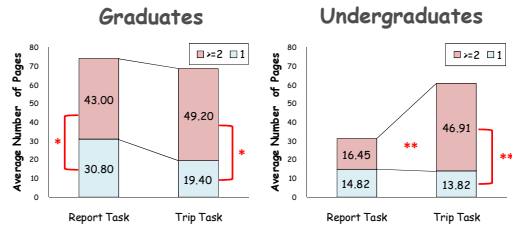
Undergraduates

Graduates have more straight-forward seeking strategies in Report tasking than undergraduates, who have to read more carefully for deeper pages.

"Web action categories"

✓ Search: searching using search engine
✓ Link: clicking on page links
✓ Next: going to next page
✓ Back: going back to previous page
✓ Jump: going to bookmarked or history page
✓ Browse: browsing new search results
✓ Submit: clicking submit button
✓ Bookmark: adding bookmarks
✓ Change: changing from one tab to another
✓ Close: closing tabs or windows

Outcomes

(Detailed info is available at **http://cres.jpn.org/**)

• Terai et al., IIix2008 (Oct., 08)
• Kando et al., ASIS&T panel (Oct., 08)
• Egusa et al., EVIA (Dec., 08)
• Kando et al., Dagstuhl Seminar (Mar., 09)
• Miwa, Organizing a Panel at ASIS&T (Oct., 09)
• Saito et al., SIGIR Workshop on UIIR, (Jul., 09)
• Egusa et al., HICSS 2009, (To appear)

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