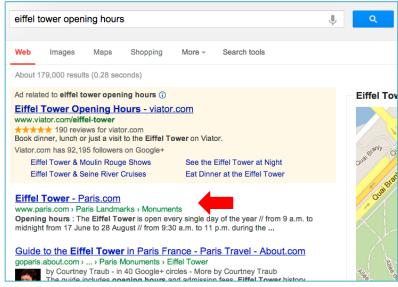# Supporting Orientation during Search Result Examination

**HENRY FEILD**, University of Massachusetts-Amherst

**RYEN WHITE**, Microsoft Research

**XIN FU**, LinkedIn

# Opportunity

Beyond supporting result selection, search systems must also help searchers situate or orient themselves within results they visit.

- Result clicks take users to top of landing pages
- User must then determine:
  - Is the snippet on page (vs. in meta-data)?
  - Where is the snippet on page?

# Current Orientation Practice

- 48-person user study (more later in the talk)

- Asked participants about current search practice

- Results showed:

  - Searchers frequently seek snippets on landing pages

    - 56% of participants reported doing this for >50% searches

  - However, people use inefficient strategies such as skimming and scanning

  - Few use find-in-page (Ctrl-F)

**Current orientation methods
(used by our study participants)**

| *Method* | *% users (n)* |
|----------|---------------|
| Ctrl-F | 10.53% (4) |
| **Skim/Scan** | **68.42% (26)** |
| Both | 21.05% (8) |

# A Broader User Sample

- 90% of all US Web users do not know Ctrl-F

- Teaching Ctrl-F → **+12%** search efficiency

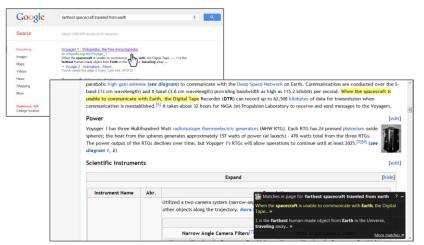- Learning new skill (Ctrl-F) can be challenging, especially remotely

- Need to offer support to help users quickly find relevant information on landing pages
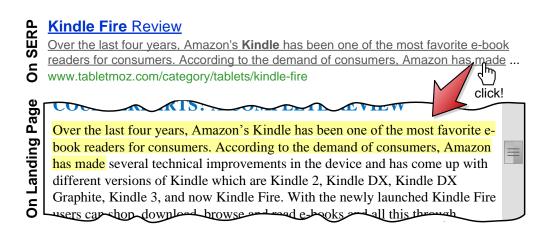
# Current Orientation Support

- Keyword highlighting on landing pages

- Thumbnail previews
  – No landing-page support
  – No transition support
  from SERP to result

- Google Quick Scroll
  – No SERP support
  – No gradual transition

# Clickable Snippets



Provides clear link from SERP snippet to landing-page content

Supports orientation in three ways:

**1. SERP:** Text appearing in landing page <u>underlined</u> (+ clickable)

**2. Transition:** Immediate – Auto-scroll to part of page directly

                     Gradual – Sequence of fades, moves & auto-scroll

**3. Landing page:** Snippet text is highlighted

# Study

- User study to evaluate orientation methods
- 48 participants, within-subjects design
- 6 systems, 12 tasks, users attempted all tasks
  - Each task had fixed query + 10 search results
  - Results scraped before study and fixed for everyone
- Experiment controlled through study dialog
- Entry, per-task, per-system, and exit surveys
- System event logging and gaze tracking

# Study - Research Questions

- RQ1 (Preview Strategy): Which type of orientation support **from the SERP** is most effective and most positively perceived?

- RQ2 (Highlighting Strategy): Which type of orientation support **from the landing page** is most effective and most positively perceived?

- RQ3 (Transition Strategy): Which type of orientation support **during the transition** is most effective and most positively perceived?

# System Capabilities, Link to RQs

| System | Preview Strategy | Highlighting Strategy | Transition Strategy |
|---|---|---|---|
| Baseline | None | None | None |
| Term Highlighting | None | Keyword highlighting | None |
| Snippet Highlighting | None | Snippet highlighting | None |
| Thumbnail Preview | Thumbnail | None | None |
| Clickable Snippet - Gradual | Clickable Snippets | Snippet highlighting | Gradual |
| Clickable Snippet - Immediate | Clickable Snippets | Snippet highlighting | Immediate |

RQ1: Preview Strategy – Orienting users on SERP
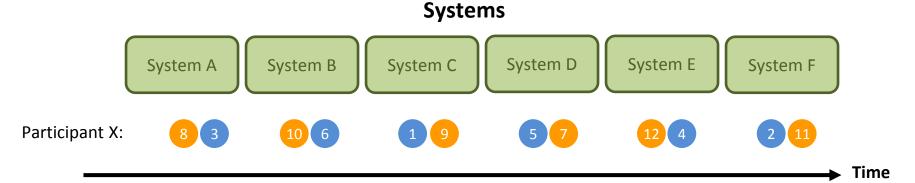- None vs. Thumbnail vs. Clickable snippets

RQ2: Highlighting Strategy – Orienting users on landing page
- None vs. Keyword highlighting vs. Snippet highlighting

RQ3: Transition Strategy – Orienting users during the transition
- None vs. Gradual vs. Immediate

# Study Design

## Systems

| System A | System B | System C | System D | System E | System F |
|---|---|---|---|---|---|

Participant X:   8  3      10  6      1  9      5  7      12  4      2  11

→ **Time**

Randomized task and system order
50% of tasks needed scrolling to view answer, 50% did not

## 48 users in total, 8 per system-task pair

| | T1 | T2 | ... | T11 | T12 |
|---|---|---|---|---|---|
| **Sys A** | 8 | 8 | | 8 | 8 |
| **Sys B** | 8 | 8 | | 8 | 8 |
| **Sys C** | 8 | 8 | | 8 | 8 |
| **Sys D** | 8 | 8 | | 8 | 8 |
| **Sys E** | 8 | 8 | | 8 | 8 |
| **Sys F** | 8 | 8 | | 8 | 8 |

### Tasks

1  4
2  5
3  6

Do not require scrolling

7  10
8  11
9  12

Require scrolling

# Tasks

**Query selection process:**
- Select frequent / high click entropy from Bing logs
- Formulated a task per query using its results
- Slightly modified result lists such that:
  - One relevant page distributed over ranks across tasks
- Manually marked up results: keyword highlighting, snippet highlighting, relevant passage, and term offsets

**Example task:**

*Query (shown to participant on result page): [kindle fire]*
*Description: Aside from the Kindle Fire, what were four versions of the Kindle that Amazon released to address technical improvements demanded by users?*
*Answer: Kindle 2, Kindle DX, Kindle DX Graphite, Kindle 3*

# Perceptions of Orientation Support

- Participants provided their perceptions of orientation support offered in the system on SERP, transition, landing page (five-point scales, higher = better)
- Clickable snippets (esp. Gradual) was preferred on many levels
- Thumbnail preview helped set expectations about landing page: "previews were nice because I could see if the page structure was likely to include what I was looking for"

| Orientation location | Measure | Baseline | | Thumbnail Preview | | Clickable Snippets | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gradual | | Immediate | |
| | | M | SD | M | SD | M | SD | M | SD |
| SERP | Assisted selection | 3.83 | 1.21 | 3.91 | 1.15 | **4.26** | **1.01** | 4.23 | 1.00 |
| | Set expectations | 3.80 | 1.08 | **4.30** | **1.03** | 4.02 | 1.09 | 3.97 | 1.13 |
| Transition | Helped transition | 3.46 | 1.07 | 3.71 | 0.76 | **4.22** | **0.88** | 4.16 | 0.95 |
| | Locate relevant info. | 3.02 | 1.18 | 3.39 | 1.04 | **3.95** | **0.98** | 3.87 | 1.02 |
| | Caption-page assoc. | 3.49 | 1.07 | 3.63 | 1.14 | **4.35** | **0.92** | 4.09 | 0.96 |
| Landing page | Ease of finding info. | 3.45 | 1.04 | 3.59 | 1.17 | **4.11** | **0.85** | 3.88 | 0.96 |
| | Speed of finding info. | 3.35 | 1.04 | 3.47 | 1.21 | **4.09** | **0.95** | 4.04 | 0.90 |
| | Highlight obtrusive | n/a | n/a | n/a | n/a | 2.09 | 1.18 | 2.02 | 1.01 |
| | Highlight useful | n/a | n/a | n/a | n/a | 3.56 | 1.41 | 3.46 | 1.32 |

# Perceptions of Orientation Support

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- Clickable snippets (esp. Gradual) was preferred on many levels
- Thumbnail preview helped set expectations about landing page: "previews were nice because I could see if the page structure was likely to include what I was looking for"
- Snippet highlighting was preferred over term highlighting

| Orientation location | Measure | Baseline | | Term Highlighting | | Snippet Highlighting | |
|---|---|---|---|---|---|---|---|
| | | M | SD | M | SD | M | SD |
| SERP | Assisted selection | 3.83 | 1.21 | 3.79 | 1.24 | 3.80 | 0.99 |
| | Set expectations | 3.80 | 1.08 | 3.77 | 1.19 | 3.80 | 0.99 |
| Transition | Helped transition | 3.46 | 1.07 | 3.20 | 1.12 | 3.71 | 0.82 |
| | Locate relevant info. | 3.02 | 1.18 | 3.12 | 1.20 | 3.52 | 0.92 |
| | Caption-page assoc. | 3.49 | 1.07 | 3.52 | 1.22 | 3.87 | 0.94 |
| Landing page | Ease of finding info. | 3.45 | 1.04 | 3.44 | 1.27 | 3.81 | 0.94 |
| | Speed of finding info. | 3.35 | 1.04 | 3.42 | 1.29 | 3.76 | 1.00 |
| | Highlight obtrusive | n/a | n/a | **3.04** | **1.43** | 2.13 | 1.13 |
| | Highlight useful | n/a | n/a | 2.75 | 1.38 | **3.58** | **1.38** |

# Engagement w/ SERPs & Landing Pages

- Examined user engagement via gaze tracking and event logging
- Longer scan paths and more fixations for term highlighting

| Feature | Baseline | | Term Highlighting | |
|---|---|---|---|---|
| | M | SD | M | SD |
| # landing page views | 2.79 | 2.61 | 2.88 | 2.61 |
| Scan path length (px) | 54.5k | 55.6k | 75.0k | 59.1k |
| Time until fixation on answer passage (secs) | 1.88 | 1.53 | 1.71 | 1.42 |
| # fixations | 21.12 | 18.86 | 25.36 | 23.32 |
| Scroll distance (px) | 3.8k | 5.3k | 4.6k | 6.9k |

# Engagement w/ SERPs & Landing Pages

- Examined user engagement via gaze tracking and event logging
- Longer scan paths and more fixations for term highlighting
- More efficient engagement with clickable snippets systems
- Fewer page views, but harder to find answer in page w/ thumbnail
  - *Previews used to support general awareness not orientation*

| Feature | Baseline | | Thumbnail Preview | | Clickable Snippets Gradual | | Clickable Snippets Immediate | |
|---|---|---|---|---|---|---|---|---|
| | M | SD | M | SD | M | SD | M | SD |
| # landing page views | 2.79 | 2.61 | **2.41** | **2.30** | 2.82 | 2.52 | 2.91 | 2.56 |
| Scan path length (px) | 54.5k | 55.6k | 60.8k | 57.2k | 46.5k | 52.8k | **45.7k** | **47.5k** |
| Time until fixation on answer passage (secs) | 1.88 | 1.53 | 1.89 | 1.84 | **1.08** | **1.22** | 1.13 | 1.11 |
| # fixations | 21.12 | 18.86 | 21.61 | 21.03 | **15.67** | **15.45** | 16.45 | 16.90 |
| Scroll distance (px) | 3.8k | 5.3k | 4.6k | 5.9k | **2.6k** | **3.8k** | 2.9k | 3.4k |

# Task Completion

- Examined many task completion metrics, including time, correctness
- Participants most successful and efficient w/ clickable snippets

| Feature | Baseline | | Clickable Snippets Gradual | | Clickable Snippets Immediate | |
|---|---|---|---|---|---|---|
| | M | SD | M | SD | M | SD |
| Success level | 4.27 | 1.31 | **4.84** | **0.82** | 4.81 | 0.95 |
| Time until relevant page visit (min:sec) | 1:36 | 1:23 | 1:13 | 0:57 | 1:16 | 0:55 |
| Duration (min:sec) | 2:44 | 1:55 | 2:22 | 1:53 | 2:27 | 1:58 |
| Answer page visit | 68.75% | | 73.96% | | **73.96%** | |
| Answer correctness | 63.54% | | **72.92%** | | 71.88% | |
| Answer found on page | 92.37% | | **98.59%** | | 97.19% | |

# Task Completion

- Examined many task completion metrics, including time, correctness
- Participants most successful and efficient w/ clickable snippets
- Thumbnails slowest time to first relevant (additional review time), keyword highlighting was slowest overall (most distracting)

| Feature | Baseline | | Term Highlighting | | Snippet Highlighting | | Thumbnail Preview | |
|---|---|---|---|---|---|---|---|---|
| | M | SD | M | SD | M | SD | M | SD |
| Success level | 4.27 | 1.31 | 4.49 | 1.10 | 4.46 | 1.19 | 4.47 | 0.93 |
| Time until relevant page visit (min:sec) | 1:36 | 1:23 | 1:35 | 1:24 | 1:37 | 1:23 | **1:55** | **1:25** |
| Duration (min:sec) | 2:44 | 1:55 | **3:23** | **1:47** | 2:44 | 2:01 | 2:43 | 1:53 |
| Answer page visit | 68.75% | | 68.75% | | 68.75% | | 71.87% | |
| Answer correctness | 63.54% | | 64.58% | | 64.58% | | 66.67% | |
| Answer found on page | 92.37% | | 93.93% | | 93.93% | | 92.76% | |

# Overall Preferences

- Participants provided final ranking of six systems
- >50% preferred a clickable snippets system (67% had Clickable Snippet in top 2)
- Gradual preferred: emphasized association between snippet and caption, e.g., "transition really led your eye on the landing page"

| System | Rel. Rank | # participants who assign rank to system | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| ClickableSnippets Gradual | 2.85 | 16 | 8 | 6 | 7 | 7 | 4 |
| ClickableSnippets Immediate | 3.23 | 9 | 12 | 8 | 4 | 8 | 7 |
| SnippetHighlighting | 3.35 | 6 | 7 | 14 | 11 | 5 | 5 |
| TermHighlighting | 3.69 | 5 | 11 | 5 | 8 | 11 | 8 |
| ThumbnailPreview | 3.75 | 8 | 5 | 6 | 11 | 8 | 10 |
| Baseline | 4.13 | 4 | 5 | 9 | 7 | 9 | 14 |

# Summary of Findings

Clickable snippets were preferred along a number of dimensions, both subjective and objective:

- **RQ1 (Preview Strategy):**
    - Snippet underlining preferred and more effective
    - Previews set expectations, less useful for navigation
- **RQ2 (Highlighting Strategy):**
    - Snippet highlighting preferred and more effective
    - Term highlighting was obtrusive and distracting
- **RQ3 (Transition Strategy):**
    - Gradual transitions preferred over immediate

# Conclusions

- Participants preferred and were more effective with the two clickable snippets systems
- Preference for gradual transition – but requires more time, need to understand better cost-benefit tradeoffs

Future directions:
- Follow-up study comparing with Ctrl-F
- Automate snippet-content matching:
  - Plenty of technical challenges in bringing Clickable Snippets to production: dynamic pages, ill-formed HTML, etc.
- Combining multiple methods, blended and non-text search settings, and mobile search scenarios

# Tasks

**Do Not Require Scrolling**

| | | |
|---|---|---|
| How many surveys does the United States Bureau of Labor Statistics use to gather statistics to calculate unemployment measures? | How many craigslist sites are there world wide? Across how many countries? | How much RAM is the iPhone 5 -- the coming, but as-yet unreleased iPhone -- speculated to have? |
| Find the name of the mutual fund for which Medco Health Solutions is its top holding. The mutual fund was a top pick in 2011. | Find the other half of this quote from Clive Davis during the eulogy he gave at Whitney Houston's funeral: "Whitney lived music and..." | Why is Black Sabbath (not Ozzy and Friends) now only playing one 2012 show, as opposed to the several European shows they had originally planned? |

**Require Scrolling**

| | | |
|---|---|---|
| What two actors/actresses stared in the 1936 movie "The Walking Dead"? | Who won the April 1st NASCAR race in Martinsville? | Aside from the Kindle Fire, what were four versions of the Kindle that Amazon released to address technical improvements demanded by users? |
| How much is the book deal Amanda Knox signed with HarperCollins worth? | What magazine did Harold Ramis inform back in 2005 that he wanted Ben Stiller to play a role in the upcoming "Ghostbusters 3" movie? | What is Peter Kantorowski's reason for not visiting his mother in over 8 months? |