

Watching Them Watching Me

Browser Extensions' Impact on User Privacy Awareness and Concern

Florian Schaub, Aditya Marella, Pranshu Kalvani, Blase Ur,
Chao Pan, Emily Forney, Lorrie Faith Cranor

Master of Science in
Information Technology



Online Tracking

CNN Home Live TV

Justice Scalia dies at 79



Replacement fight brews
Conservative giant dies in his sleep | Who could be on Obama's short list

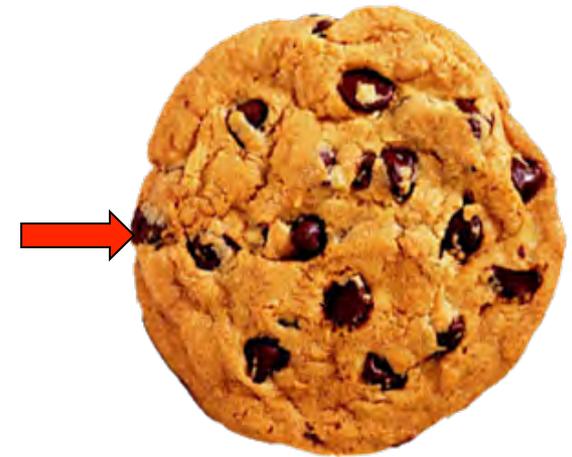
Top stories

'Life-threatening' cold sweeping in 2 h

```
Elements Console Sources Network Timeline >> 16 X
t>
<script type="text/javascript" src="http://rtax.criteo.com/delivery/rtax/rtax.js?netId=4157&cookieName=crtg_trnr&rnd=87286486010&varName=crtg_content"></script>
<script async src="http://widgets.outbrain.com/outbrain.js"></script>
<meta content="IE=edge,chrome=1" http-equiv="X-UA-Compatible">
<meta charset="utf-8">
<meta content="text/html" http-equiv="Content-Type">
<meta name="viewport" content="width=device-width, initial-scale=1.0, minimum-scale=1.0">
<link href="/favicon.ie9.ico" rel="Shortcut Icon" type="image/x-icon">
<link href="http://i.cdn.turner.com/cnn/.e/img/3.0/global/misc/apple-touch-icon.png" rel="apple-touch-icon" type="image/png">
▶ <iframe src="javascript:false" title style="width: 0px; height: 0px; border: 0px; display: none;"></iframe>
<script type="text/javascript" src="http://z.cdn.turner.com/ads/cnn/cnn_homepage.js"></script>
<script async src="http://a.visualrevenue.com/vrs.js"></script>
<script type="text/javascript" src="http://rtax.criteo.com/delivery/rtax/rtax.js?netId=4157&cookieName=crtg_trnr&rnd=46068684011&varName=crtg_content"></script>
... <script type="text/javascript" src="http://www.googletagmanager.com/tag/js/gtm.js"></script>
<script type="text/javascript" async src="http://aax.amazon-adsystem.com/e/dtb/bid?src=31596u=http%3A%2F%2Fwww.cnn.com%2F&cb=8659917&t=2000"></script>
<script src="http://z.cdn.turner.com/xslo/cvp/easyxdm/js/easyXDM.ugly.js"></script>
<script type="text/javascript" async src="http://cdn.krxd.net/controltag/confid=ITb_4eq0"></script>
▶ <script>...</script>
<title>CNN - Breaking News, Latest News and Videos</title>
html head script
```

Online Tracking

The screenshot shows the Guitar Center website with a search for 'fender stratocaster'. The page features a navigation bar with categories like 'Product', 'Used Gear', 'Platinum', 'Vintage', 'Outlet', 'GC Pro', 'Lessons', and 'Repairs'. A prominent banner for 'PRESIDENTS DAY SALE' is visible. Below the banner, the search results are displayed in a grid view, showing four different Fender Stratocaster guitar models. The first guitar is marked 'ON SALE', and the other three are marked 'TOP SELLER'. The page also includes a 'Refine' sidebar with filters for 'Find In Stores', 'Category', and 'Brands'.



A9837%^6528

Interest: Guitars

Online Tracking

PRESIDENTS DAY COUPON ▶ COUPON CODE: PREZ2016

Musician's Friend 800-449-9128

Subscriptions Order Status Help

Shop by Category - Hot Deals Looking for COUPONS? Call us Login Your Account Cart

★ PRESIDENTS DAY DOORBUSTERS ★ SAVE UP TO \$300 Shop Now

Home > Accessories > Fretted Instrument Accessories & Parts > Fretted Instrument Accessories > Straps & Strap Locks > Straps

Straps

Subcategories

- Guitar Straps (447)
- Bass Specialty Straps (7)
- Banjo Straps (13)
- Mandolin Straps (6)

Narrow By

Brands

Search Brands

Clayton (3)

D'Addario (1)

Straps (473)

Results 1 - 20 of 473 matches Page: 1 2 3 4 5 6 of 24 Next >

Sort by: Best Selling View as: Grid List Display: 20 40 60

Top Rated	Price Drop	Price Drop	Best Seller
Ernie Ball 2" Poly Strap ★★★★★ (265 Reviews) Starting at \$6.33	Levy's Soft Suede Guitar Strap ★★★★★ (130 Reviews)	DiMarzio 2" Nylon ClipLock Guitar Strap ★★★★★ (190 Reviews)	Perri's 2" Nylon Guitar Strap ★★★★★ (79 Reviews) \$3.99



A9837%^6528

Interest: Guitars

Interest: Guitar Straps

Online Tracking

www.cnn.com/world

World » Africa | Americas | Asia | Europe | Middle East

Live TV U.S. Edition + menu

Around the world

More from Africa



The snails spreading fever across Africa

Girl with 'butterfly skin' dies

More from Americas



Pioneering electric race series resumes on streets of Buenos Aires

2 teens killed sledding on closed Olympic track

 <p>Perri's 2-1/2" Suede Leather Guitar Strap ...</p>	 <p>Franklin Strap 2.5" Black Suede Guitar S...</p>
 <p>Franklin Strap 3" Chocolate Leather G...</p>	 <p>Franklin Strap 2.5" Honey Suede Guitar ...</p>
 <p>LM Products PM-8 Premier Suede Guitar...</p>	 <p>Levy's Soft Suede Guitar Strap Black</p>

Privacy Extensions

The screenshot shows a web browser window displaying the CNN website. A Ghostery privacy extension is active, showing a notification that 13 trackers were found on the page. The extension interface is overlaid on the right side of the browser, listing the following trackers with their categories and status:

- ChartBeat (Analytics) - Status: On
- DoubleClick-DART (Advertising) - Status: Off
- Dynamic Logic (Beacons) - Status: On
- Facebook Connect (Widgets, Social) - Status: On
- InsightExpress (Analytics, Analytics) - Status: On
- Krux Digital (Beacons) - Status: On

At the bottom of the extension interface, there are three buttons: "Pause Blocking", "Whitelist Site", and a question mark icon.

The background shows the CNN website with a "BREAKING NEWS" banner about Ebola patient Nina Pham, and a large headline "OBAMA CHOOSES EBOLA CZAR". Below the headline is a video player for a news segment about "Klain to oversee U.S. response, sources tell CNN".

Many Privacy Extensions

DoNotTrackMe
2 trackers blocked at cnn.com

Warning!
warez.com
This website has a poor reputation based on user ratings

Trustworthiness: Very poor
Child safety: Very poor

ABP
Enabled on this site
19 on this page
12,456 in total

- Temporarily allow cnn.com
- Allow cnn.com
- Temporarily allow optimizely.com
- Allow optimizely.com
- Temporarily allow truste.com
- Allow truste.com
- Temporarily allow dl-rms.com
- Allow dl-rms.com
- Temporarily allow turner.com
- Allow turner.com
- Temporarily allow insightexpressai.com
- Allow insightexpressai.com
- Temporarily allow revsci.net

- Don't track my browsing here
- Don't track my email here
- Don't track my credit card here
- Don't track my phone here

Wow! You've blocked 109 trackers!

Terms of Service
Didn't Read

CLASS C The terms of service are okay but some issues need your consideration.

Google keeps your searches and other identifiable user information for an undefined period of time

Google collects a lot of information about the services you use and how you use them, including when you visit a website using a Google service for advertisement. In the past, Google stated in their Privacy Policy: "We strike a reasonable balance between the competing pressures we face, such as the privacy of our users, the security of our systems and the need for innovation. We believe anonymizing IP addresses after 9 months and cookies in our search engine logs after 18 months strikes the right balance". Today, these limitations of time are gone from the Privacy Policy, although some pages still acknowledge this. So we must conclude that Google has decided to stop trying to find the right balance between privacy of users and their own needs.

Limited copyright license to operate and improve all Google Services

DISCONNECT
these numbers

Category	Count
Advertising	6 requests
Analytics	2 requests
Social	0 requests
Content	2 requests

Whitelist site Show counter

Time saved	Bandwidth saved	Requests secured
100%	100%	100%

Ghostery found 10 trackers
www.cnn.com

Audience Science
2 requests

Detected tracker source URLs:
http://s.revsci.net/gateway/gw.js?csid=A09801

ChartBeat
Analytics

Dynamic Logic
Beacons

Facebook Connect
Widgets, Social

InsightExpress
Analytics, Analytics

Pause Blocking | Whitelist Site

Research Questions

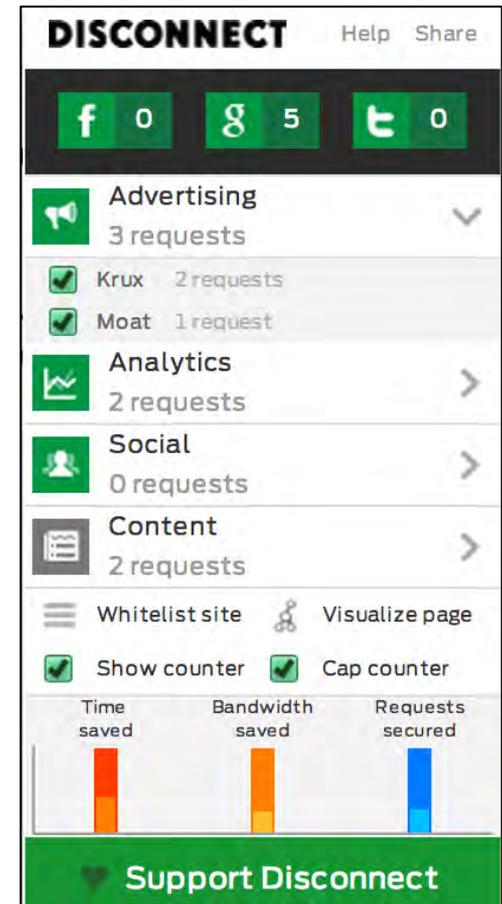
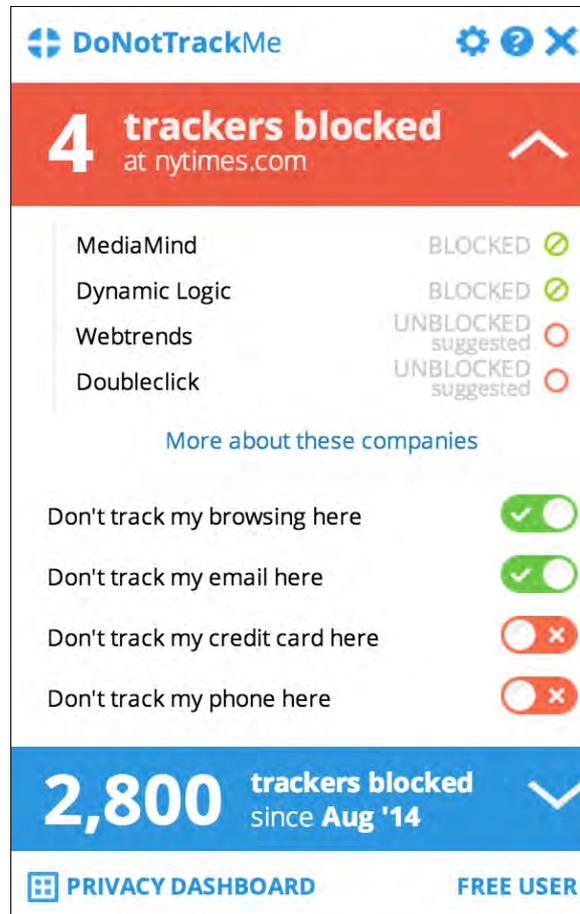
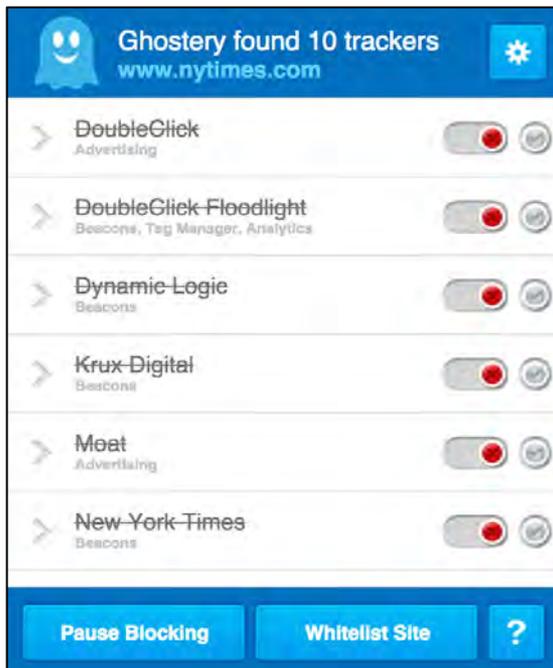
- How do extensions influence privacy awareness and concerns?
- How do different interface elements shape users' awareness and concerns?

Browser Extensions Evaluated



User Interface Elements

Main Panels



*all on nytimes.com
at the same time*

User Interface Elements

The screenshot displays the New York Times homepage with a browser address bar at the top showing 'www.nytimes.com'. The main navigation includes 'SECTIONS', 'SEARCH', 'SUBSCRIBE NOW', and 'LOG IN'. The page features a large masthead with the newspaper's name and a secondary navigation bar with categories like 'World', 'U.S.', 'Politics', etc. The main content area is divided into several sections: a Supreme Court memo, a Grammy Awards article with a photo of Taylor Swift, and an opinion piece. A sidebar on the right contains 'The Opinion Pages' and a list of analytics tools. A red box highlights this sidebar list.

SECTIONS **SEARCH** **SUBSCRIBE NOW** **LOG IN**

U.S. INTERNATIONAL 中文

The New York Times

Tuesday, February 16, 2016 Today's Paper Video 63°F Hang Seng +1.22% ↑

World U.S. Politics N.Y. Business Opinion Tech Science Health Sports Arts Style Food Travel Magazine T Magazine Real Estate ALL

SUPREME COURT MEMO
In His Dissent, Clues to Scalia's Desires for His Successor
By ADAM LIPTAK
In a passage from his dissent from the Supreme Court's decision in June on same-sex marriage, Justice Antonin Scalia criticized the court's lack of diversity.

Republicans Close Ranks Over Justice's Replacement
By MICHAEL D. SHEAR and JENNIFER STEINHAUER
Senate
Republicans appeared to be falling in line behind their majority leader, Mitch McConnell, supporting his call to let the next president pick

THE GRAMMY AWARDS

Robyn Beck/AFP/Getty
Swift and Lamar Win at Grammys 2016
By BEN SISARIO 12:27 AM ET
Taylor Swift's "1989" was named album of the year, and Mark Ronson and Bruno Mars took home the prize for record of the year. Kendrick Lamar swept the rap categories.
· [Complete List of Winners](#) · [Full Coverage](#)

CRITIC'S NOTEBOOK
Big Voices, Pretty Faces and Bitter Truths
By JON PARELES 12:31 AM ET

From the Red Carpet


The Opinion Pages

ROOM FOR DEBATE
A Referendum on Justice
Would Republican refusal to consider any Obama Supreme Court nominee make constitutional issues central in November?
· [Editorial: The Supreme Court After Justice Scalia](#)
· [Blow: The Fire Meets the Wall](#)
· [Krugman: How America Was Lost](#)
· [Cohen: Will Merkel Pay for Doing the Right Thing?](#)

OP-ED CONTRIBUTOR
The Trial of Hissène Habré
By THIERRY CRUVELLIER
Never in a trial for mass crimes have the victims' voices been so dominant. And the African Union is saying: Never again.
· [Lire en français \(Read in French\)](#)
· [Op-Ed: Liberal Love for Antonin Scalia](#)
· [Campaign Stops a First for Jews](#)
· [The Stone: Is Human Getting Better?](#)

Sanders and

- ChartBeat
- ClickTale
- DoubleClick
- DoubleClick-Floodlight
- Dynamic-Yield
- Enlighten
- Facebook-Connect
- Google-Analytics
- Moat
- NetRatings-SiteCensus
- New-Relic
- Optimizely
- ScoreCard-Research-Beacon
- WebTrends

User Interface Elements

Alert Bubbles



Ghostery



DoNotTrackMe

*all on nytimes.com
at the same time*

User Interface Elements



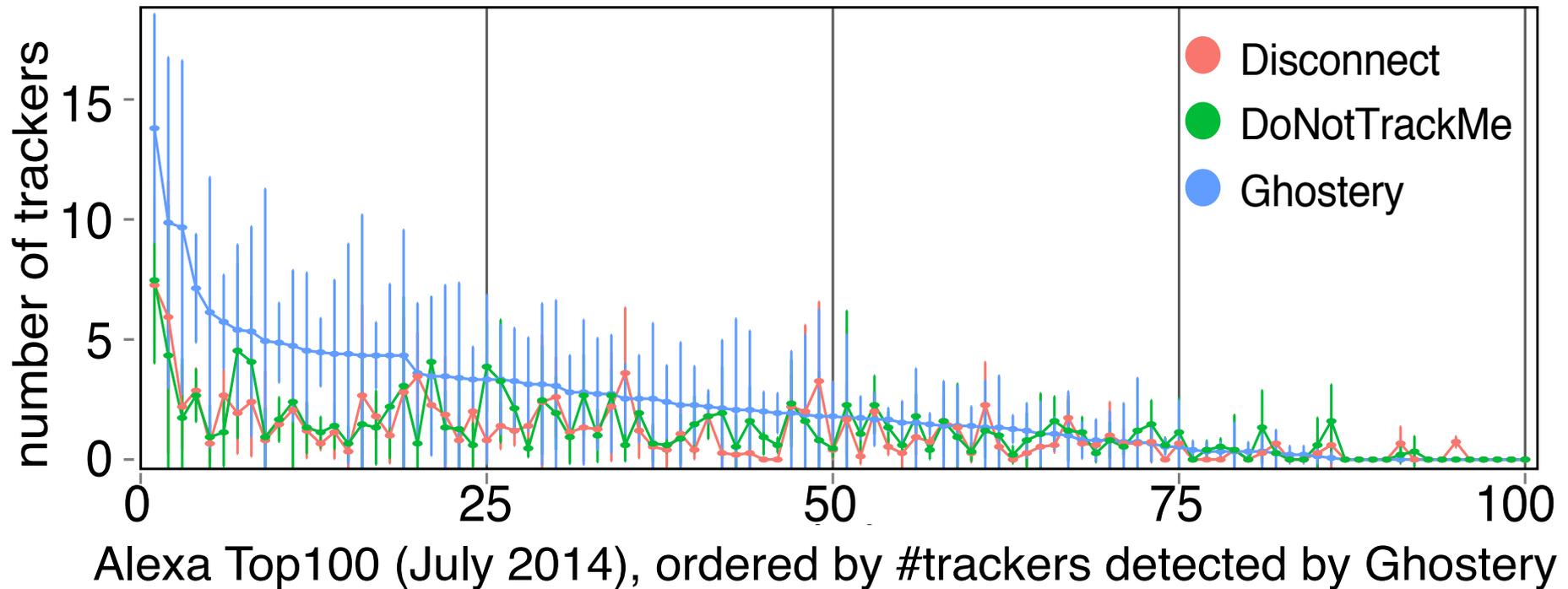
User Interface Elements

Extension Icons

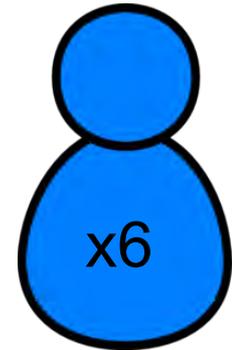
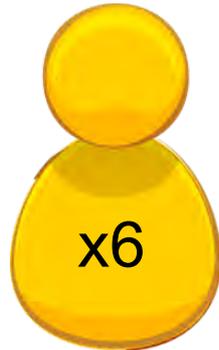
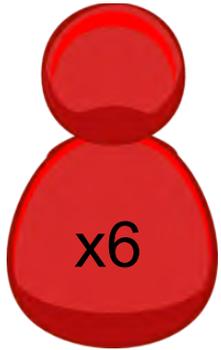


*all on nytimes.com
at the same time*

Tracker Detection Performance



Study Design



Privacy Guard

Privacy Guard helps protect your privacy online.

Privacy Guard is a cost-free privacy browser extension for Internet Explorer, Opera, Mozilla Firefox, Apple Safari, and Google Chrome.

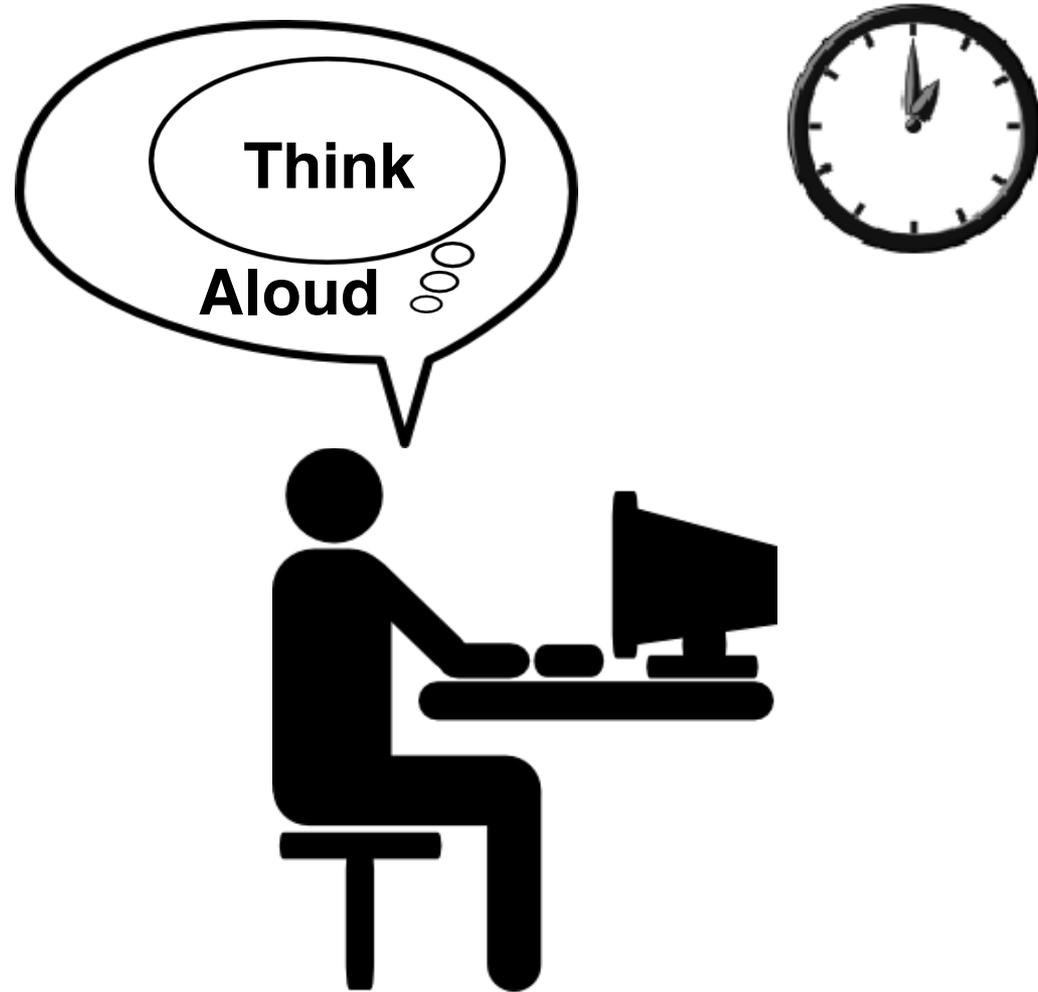
If you have any problems, please [contact us](#)

contact@privacyguard.com

Running ...

© 2014 Privacy Guard Inc. [Help](#)

Study Design



Study Design

Search Topics



Body Odor



Depression

Study Design

Websites

The logo for Veoh, featuring the word "veoh" in a lowercase, sans-serif font. The letter "o" is a solid blue circle, while the other letters are in a dark grey color.The Amazon logo, consisting of the word "amazon" in a bold, lowercase, sans-serif font. Below the text is a curved orange arrow that starts under the letter "a" and ends under the letter "n", pointing to the right.The logo for The New York Times, featuring the words "The New York Times" in a black, traditional gothic or blackletter typeface.

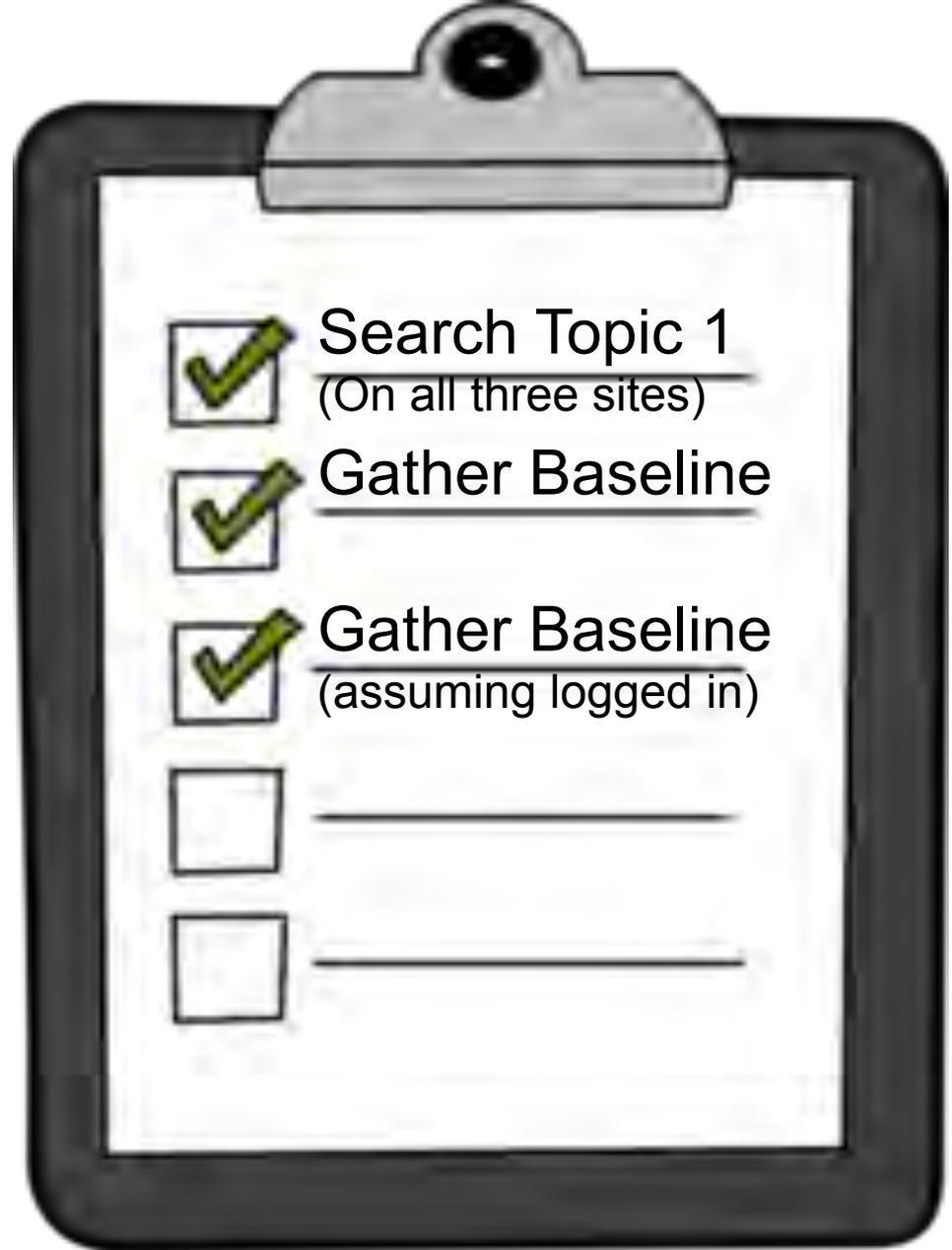
Study Design

Part 1:

Think-Aloud

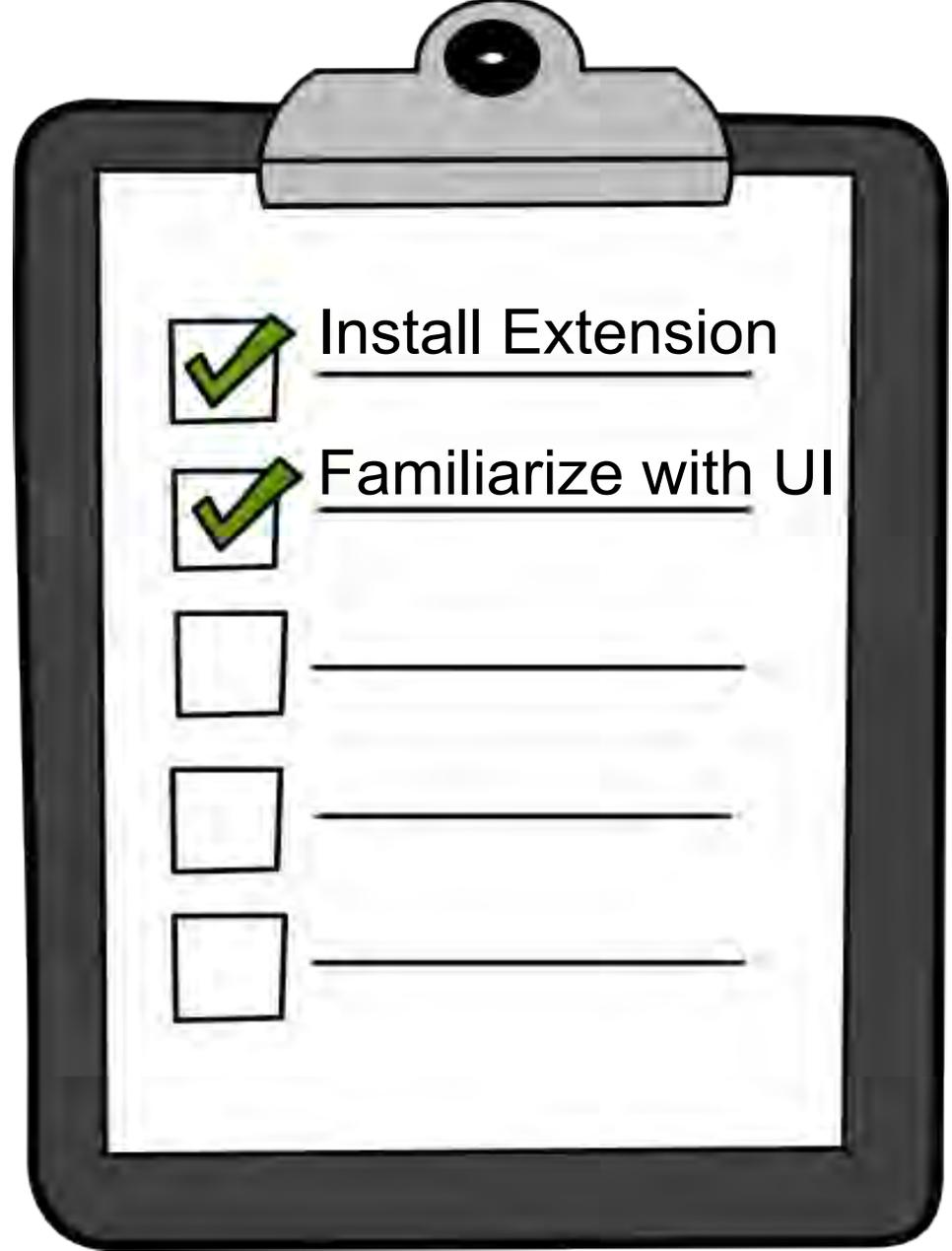
Browsing Tasks

Without Extension



Study Design

Part 2: Install Extension



Study Design

Part 3:

Think-Aloud

Browsing Tasks

With Extension



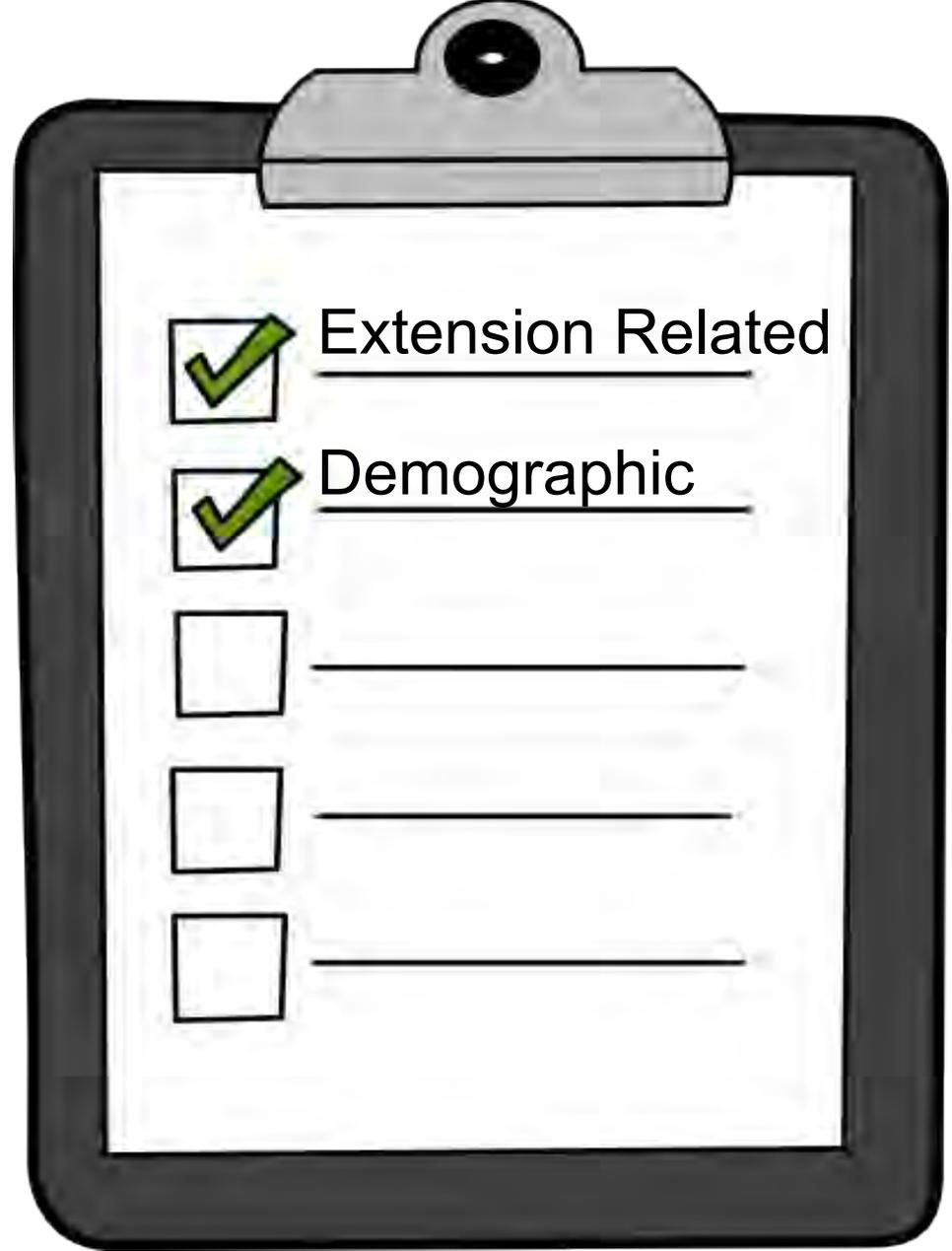
Study Design

Part 4:
Hypothetical
Scenario
With Extension
Taken Away



Study Design

Part 5: Exit Interview Questions



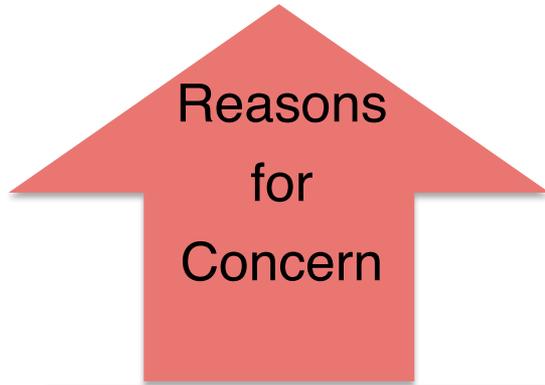
Qualitative Data Analysis

- All interviews were recorded and transcribed
- Analyzed by two researchers
- Iteratively developed coding taxonomy
- Affinity diagramming to identify themes
 - 2,623 annotations overall
 - 111 codes within 8 broad categories

Demographics

- 24 participants
 - 62% female, 38% male
 - Age: 18-63 years (median 22 years)
 - Diverse occupations (14 students)
 - 14 had installed a browser extension before

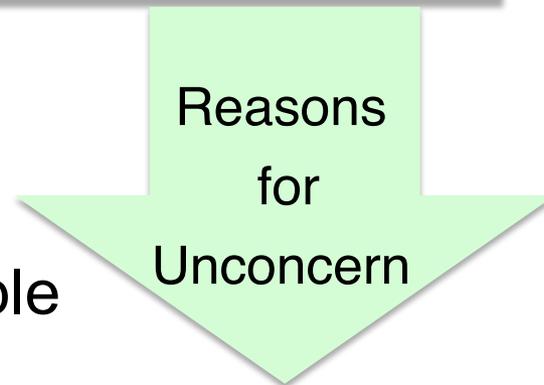
Results: Before Using Extension



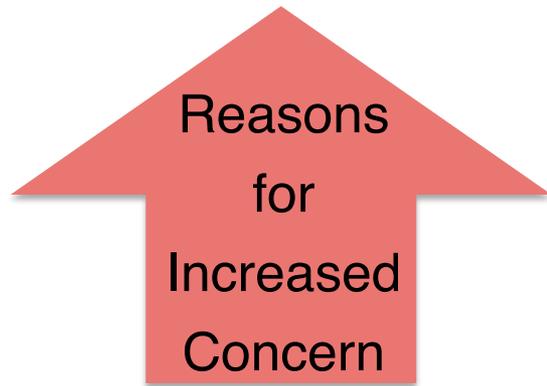
- External tracking
- Browsing activities personal
- Distrust website
- Dislike targeted ads
- Logging-in linked to user

Awareness about presence of data collection

- Nothing to hide
- Reputable/trusted website
- Activities personally un-linkable



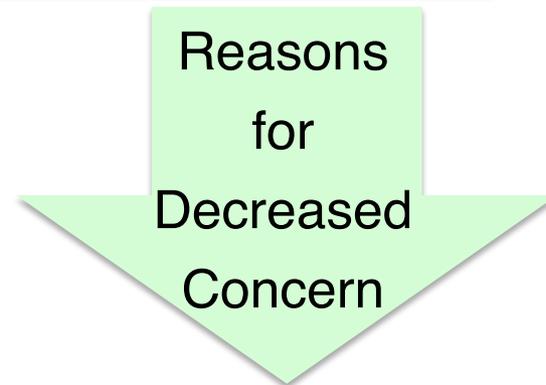
Results: While Using Extension



- More aware of tracking
- Websites/others still able to track
 - Believe extension is tracking

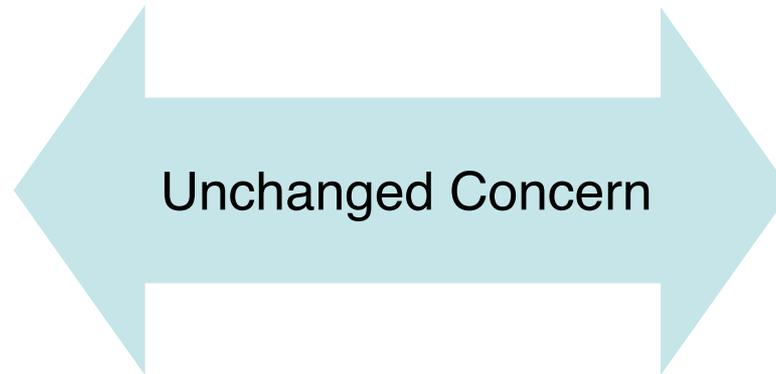
Awareness about **extent** of data collection

- Extension blocks trackers



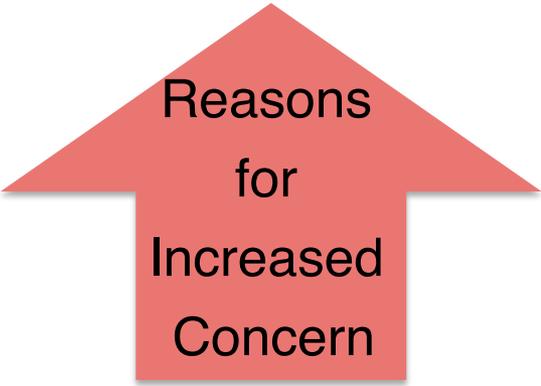
Results: While Using Extension

...contd.



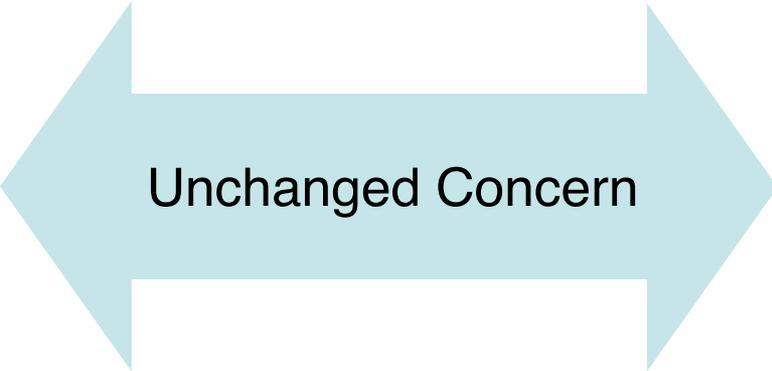
- No harm perceived from tracking
- Questioned extension's effectiveness

Results: Post Extension Removal



Reasons
for
Increased
Concern

- Increased awareness of tracking
- Perceived protection loss



Unchanged Concern

- No harm perceived from tracking

Results: Interface Elements

Installation & Documentation



- Videos are informative
- Tutorials help familiarizing UI

- User Reviews

- Jargon, and confusing descriptions
- Unexplained permission request
- Selling premium features

Results: Interface Elements

Extension Icon



- Numbers calibrate privacy concern
- Color change suggest heightened warning



- Small details not always visible

Results: Interface Elements

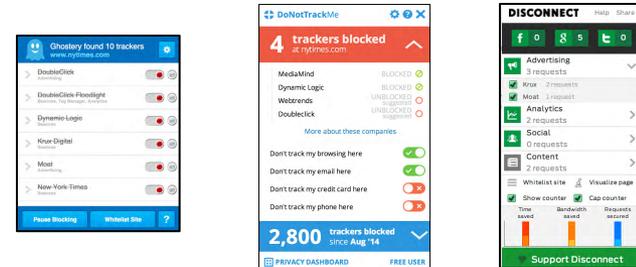
Alert Bubble



- Led people to click on main panel
- Transient, so not everyone saw it
- Annoying due to constant interruption

Results: Interface Elements

Main Panel



- List increased awareness, and concern
- Company names and purpose unknown
- Terms and tracker categories unclear
- Additional information rarely accessed

Study Limitations

- Qualitative study with 24 participants
- Limited topics, websites
- Lab setting
- Habituation effects
- Potential priming
- Anchoring

Design Implications

- Extension icon is essential
- Use alert bubble sparingly
- Integrate relevant explanations
- Avoid jargon
- Setup materials shape mental models
- Emphasize why and what

Thank you! Questions?

Pranshu Kalvani | pranshu@alumni.cmu.edu