

Designing Privacy Tools for Web Browsing

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APRIL 7, 2015

Usable Privacy and Security Guest Lecture
Carnegie Mellon University

Johnny is very shy and withdrawn, invariably helpful but with little interest in people or in the world of reality. A meek and tidy soul, he has a need for order and structure, and a passion for detail.

Is Johnny more likely to be a librarian or a farmer?

Librarian #:

Farmer #:

Thinking, Fast and Slow. Daniel Kahneman, 2013

The population of a mid size city like Durham in North Carolina is about 500 thousand people. Milwaukee is a large city in the state of Wisconsin in the north of the United States.

Average Estimate for Population of Milwaukee?

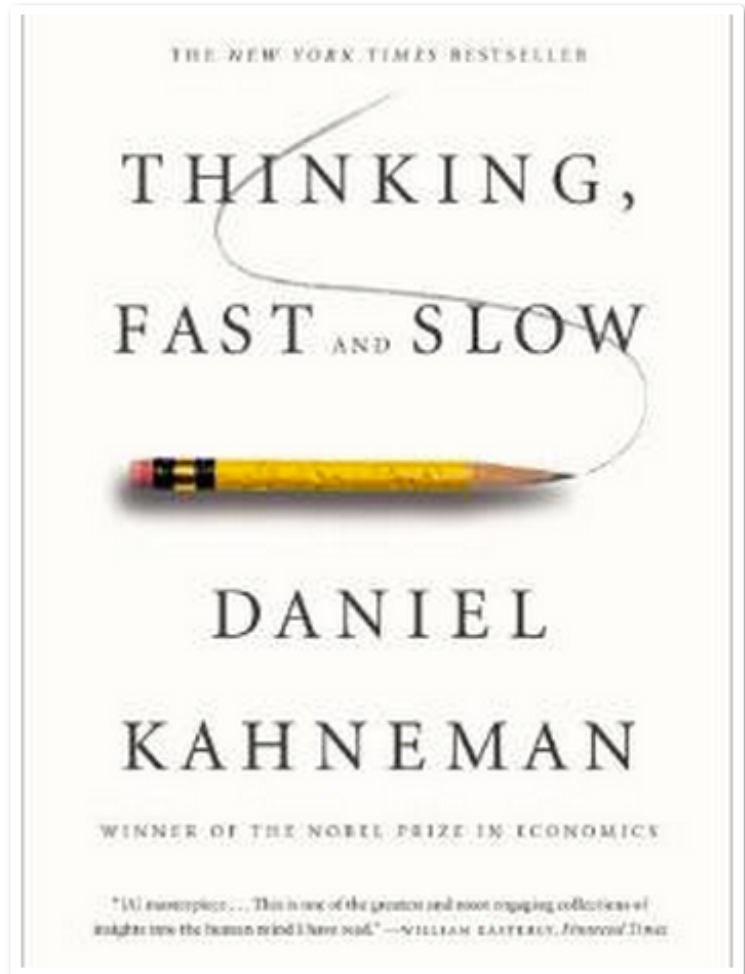
The population of a large size city like Los Angeles in California is about 14 million people. Milwaukee is a large city in the state of Wisconsin in the north of the United States.

Average Estimate for Population of Milwaukee?

Agenda

- Hurdles In Privacy Decision Making
- Choice Architecture Applied to Privacy Tools
- Group exercise: Evaluation of Web Privacy Tool
- Advertising Industry Opt-Out Tools
- Privacy Tools for Facebook
- Conclusion

Hurdles in (Privacy) Decision Making



Privacy Decision Making Under Uncertainty

Asymmetric and Incomplete information

- How user's information will be used?
- Who is collecting user's information?
- What other information the website knows about the user?
- With whom would user's information be shared?
- How does the website protect user's information?
- Can user control or limit how website uses his information?

Cognitive Limitations

Bounded Rationality

- Limited memory resources
- Limited cognitive resources
- Limited attention
- Difficult to assess and foresee risks
- Difficult to assess all alternatives

Behavioral Biases

Optimism and Overconfidence

- Underestimate Privacy Risks

Status Quo

- Conform to the norms
- Affinity to default choices

Hyperbolic Time Discounting

- Overestimate present benefits of disclosure
- Underestimate future risks

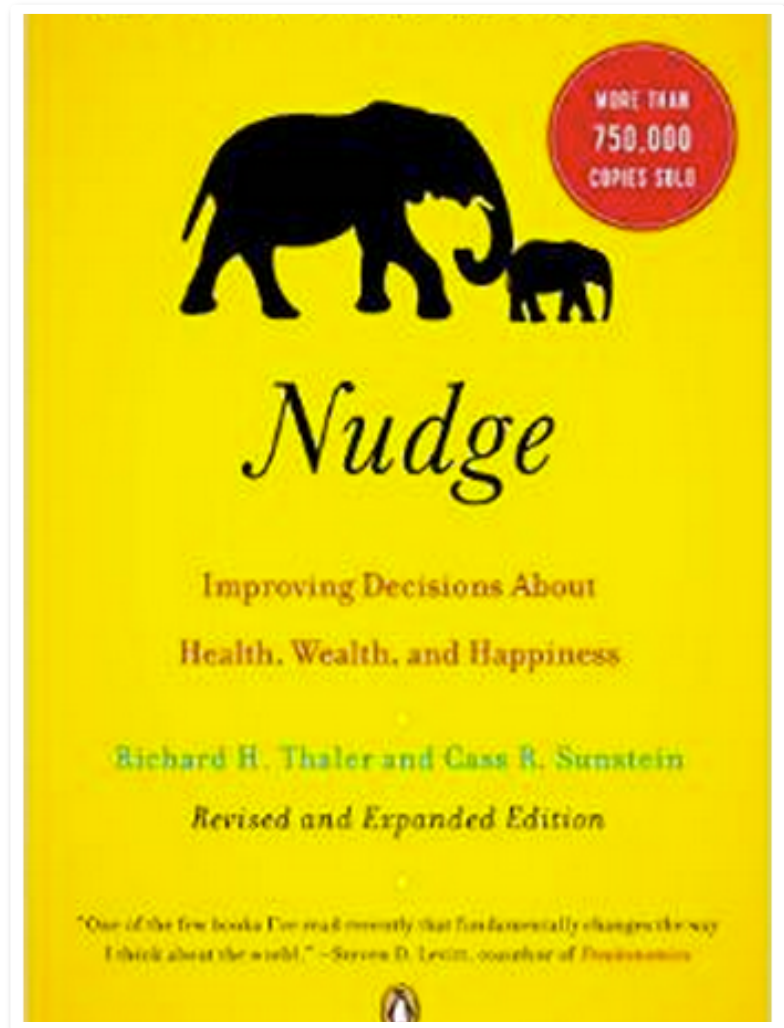
Loss Aversion

- Losses are weighted more than gains
- Endowment effect

Decision Making Heuristics

- Availability
- Representativeness
- Anchoring

Choice Architecture



Design Choices

- Information: Reduces information asymmetries and provides a realistic perspective of risks
 - Awareness
 - Education
 - Feedback
- Presentation: Provides contextual cues through the User Interface to reduce cognitive load and convey the risk properly
 - Framing
 - Ordering
 - Saliency
 - Structure

Design Choices

- Defaults: Reduce users' effort by configuring the tool according to what is most likely to conform to most users' expectations
- Incentives: Motivate users to behave according to their stated preferences
 - Cost (e.g., make it harder to make mistakes)
 - Rewards (e.g., reward for safe behavior)
- Time: Define the right moment to intervene

Tracking Blockers Browser Plugins



DISCONNECT



GHOSTERY

Short and Clear Description



Disconnect lets you visualize and block the invisible websites that track your browsing history. Click the interactive items below to find out more!

Toolbar button

The **toolbar button** shows you the total number of tracking requests on every page you go to. Click the button to see and block or unblock the requests.

Dropdown

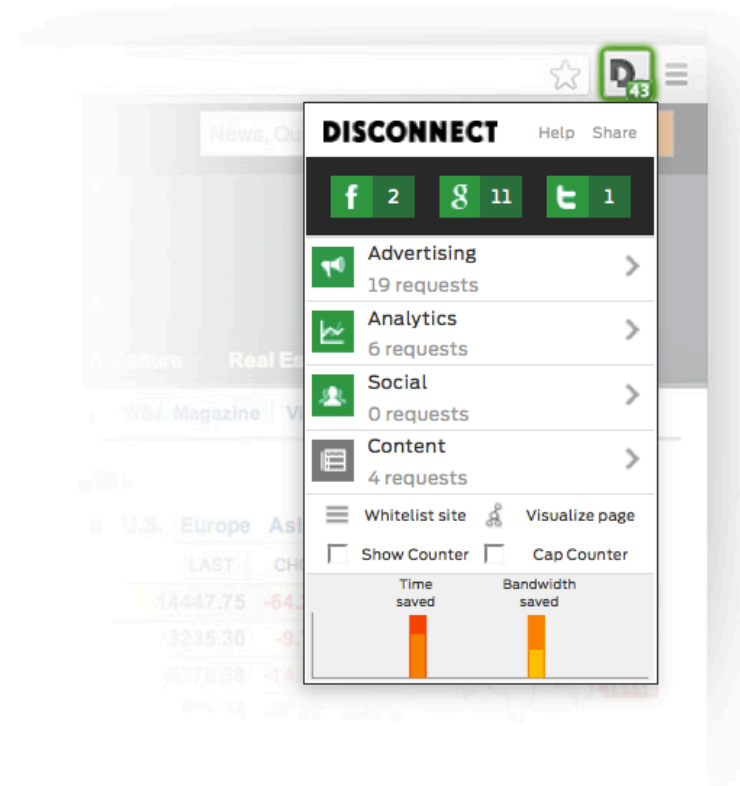
Navbar

Common tracking sites

Other tracking sites

Options

Dashboard



Visual Cues



Disconnect lets you visualize and block the invisible websites that track your browsing history. Click the interactive items below to find out more!

Toolbar button

Dropdown

The **dropdown** shows you the number of tracking requests by company. Green means the requests are blocked. Gray means they're unblocked. Click any icon or checkbox to block or unblock requests.

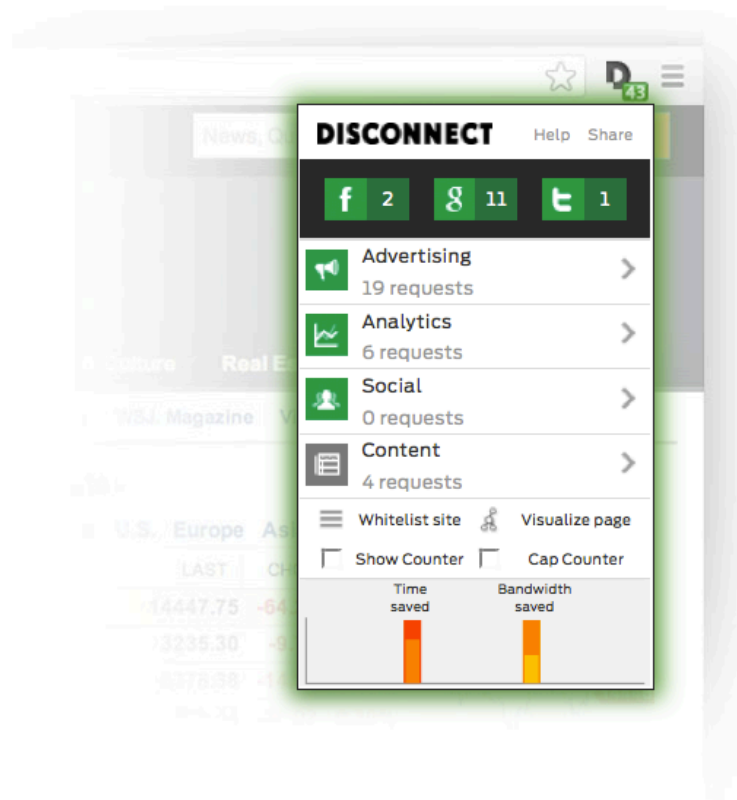
Navbar

Common tracking sites

Other tracking sites

Options

Dashboard



Salient Relevant information



Disconnect lets you visualize and block the invisible websites that track your browsing history. Click the interactive items below to find out more!

Toolbar button

Dropdown

Navbar

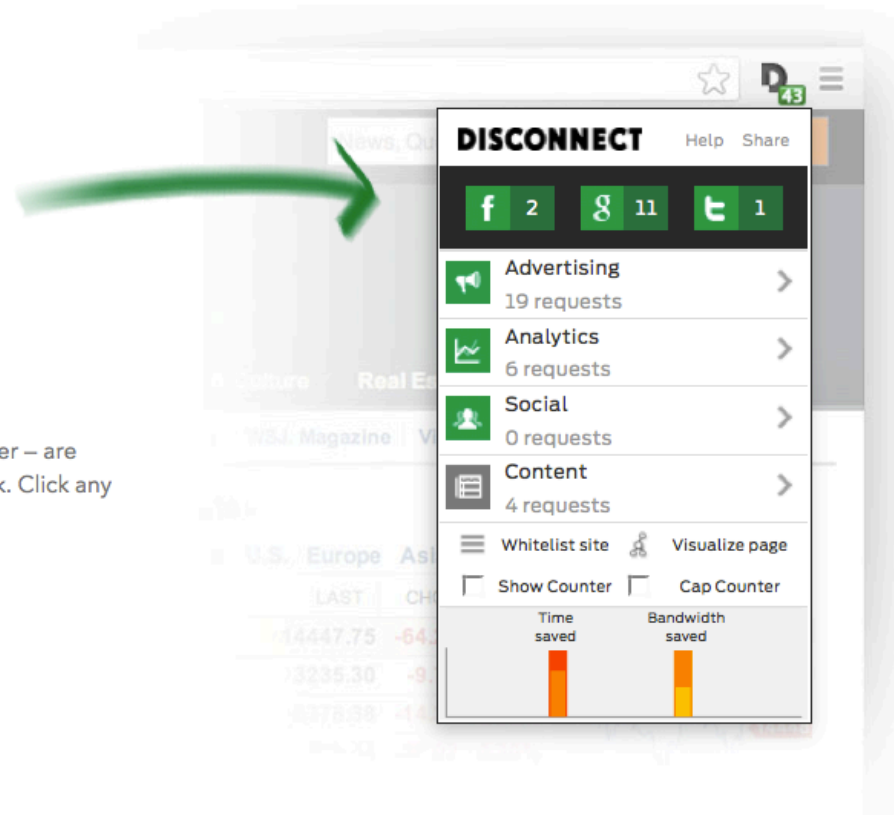
Common tracking sites

Common tracking sites – Facebook, Google, and Twitter – are shown separately to make them easy to block or unblock. Click any icon to block or unblock a site.

Other tracking sites

Options

Dashboard



Creates Awareness and Gives Feedback

The screenshot displays the New York Times website interface. At the top right, there is a navigation bar with icons for download, home, search, and a notification badge showing '51'. Below this is a browser address bar with the URL 'www.nytimes.com' and a star icon for bookmarks, along with a notification badge showing '16'. The main navigation area includes a 'SECTIONS' menu and a 'SEARCH' field. The page features a large masthead with the 'The New York Times' logo in a classic serif font. To the left of the masthead is a promotional banner for 'UNLIMITED DIGITAL ACCESS'. Below the masthead, the date 'Tuesday, April 7, 2015' is displayed, along with links for 'Today's Paper', 'Video', and weather information '56°F'. A secondary navigation bar lists various sections: World, U.S., Politics, New York, Business, Opinion, Technology, Science, Health, Sports, Arts, Style, Food, Home, and Travel. A prominent banner below the navigation bar reads 'The New York Times UNLIMITED DIGITAL ACCESS 4 WEEKS JUST 99¢'. The main content area shows several article headlines. On the left, a headline reads 'Paul Announces White House Bid, in a Test of Libertarianism'. In the center, there is a photograph of a basketball player in a white jersey jumping to shoot a ball. On the right, a headline reads 'Cuban Expectations in a New Era' by 'THE EDITORIAL BOARD', with a sub-headline stating 'Diplomatic relations with the United States have yet to be...'. The page is partially obscured by a red vertical bar on the left side.



The New York Times

Tuesday, April 7, 2015 | Today's Paper | Video



Paul Announces White House Bid, in a Test of Libertarianism

By JEREMY W. PETERS 9:55 AM ET
Senator Rand Paul of



DISCONNECT Help Share

f 0 g 5 t 3

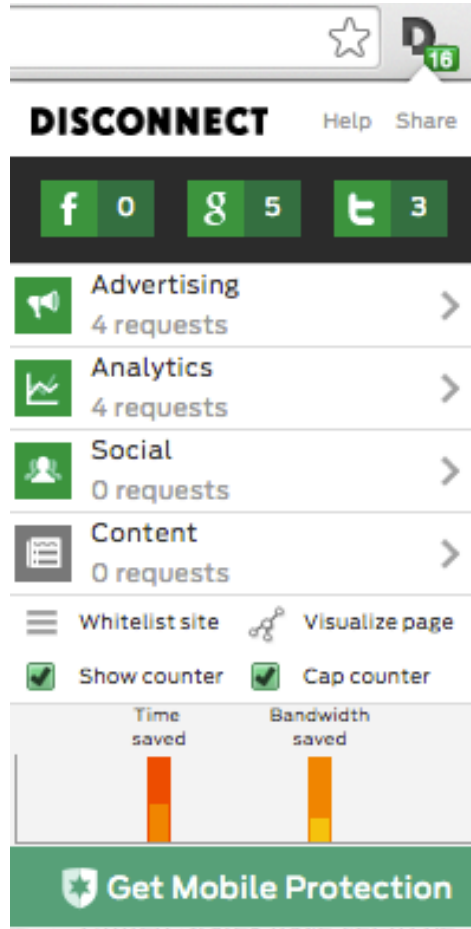
- Advertising 4 requests
- Analytics 4 requests
- Social 0 requests
- Content 0 requests
- Whitelist site Visualize page
- Show counter Cap counter

Time saved Bandwidth saved

Get Mobile Protection

United States have yet to be fully re-established, but some concrete steps are promising.

Structured Notice and Protective Default



Verbose Description



Skip Wizard

Introduction

Welcome to Ghostery for Firefox version 5.4.3!

Ghostery looks for third-party page elements (or "trackers") on the web pages you visit. These can be things like social network widgets, advertisements, invisible pixels used for tracking and analytics, and so on. Ghostery notifies you that these things are present, and which companies operate them. You can learn more about these companies, and if you wish, choose to block the trackers they operate.

This quick walkthrough will highlight some of Ghostery's options and give you a chance to set things up straight-away. You can change any of these decisions (and view more options) by visiting the full Ghostery options page at any time. If you have any questions during the process, drop us a line at support@ghostery.com.



Order of Choices Distracts Users



Skip Wizard

Ghostrank™

Help support Ghostery by sending anonymous statistical data back to Ghostery HQ.

When you enable Ghostrank, Ghostery collects anonymous data about the trackers you've encountered and the sites on which they were placed. This data is about tracking elements and the webpages on which they are found, **not you or your browsing habits.**

... [See more.](#)

Click here to enable Ghostrank

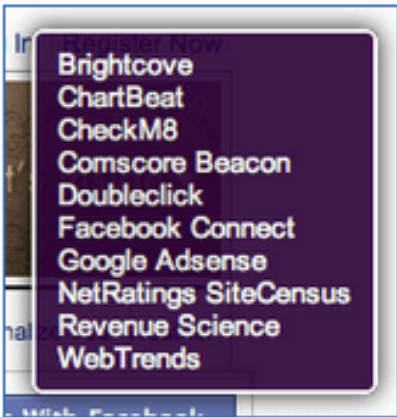


Default Active Alert Bubble



Skip Wizard

Notification



When Ghostery detects trackers on a page you're visiting, it displays the companies that operate those elements in a purple box at the top right corner of the screen. If you'd rather Ghostery work in the background, you can uncheck the box below.



There are more ways to customize the purple box on Ghostery's options page.

[Click here to enable Alert Bubble](#)

Blocking Choices Shown Late & Off by Default



Skip Wizard

Blocking

Ghostery can prevent the page elements it detects from running in your browser.

Blocking trackers will prevent them from running in your browser, which can help control how your behavioral data is tracked. Keep in mind that some trackers are potentially useful, such as social network feed widgets or browser-based games ... Blocking may have an unintended effect on the sites you visit.

Please [let us know](#) if you run into any issues.

Trackers that got blocked will be crossed out in the alert bubble and the findings panel.

Trackers | **Cookies**

Blocking **no** trackers.

When you block a tracker, that tracker is prevented from communicating with its third-party provider.

Show

Search for

A/B Testing 9 | Affiliate Marketing 47 | Analytics 116 | Audio / Music Player 4 | Behavior Tracking 48 | [Show more tags...](#)

[Select all](#) | [Select none](#) | [Expand all](#) | [Collapse all](#)

>	<input type="checkbox"/>	Advertising	978 trackers: blocking none
>	<input type="checkbox"/>	Analytics	317 trackers: blocking none
>	<input type="checkbox"/>	Beacons	380 trackers: blocking none
>	<input type="checkbox"/>	Privacy	19 trackers: blocking none
>	<input type="checkbox"/>	Widgets	290 trackers: blocking none

Discourage to Block Tracking



Skip Wizard

Blocking

Ghostery can prevent the page elements it detects from running in your browser.

Blocking trackers will prevent them from running in your browser, which can help control how your behavioral data is tracked. Keep in mind that some trackers are potentially useful, such as social network feed widgets or browser-based games ... Blocking may have an unintended effect on the sites you visit.

Please [let us know](#) if you run into any issues.

Trackers that got blocked will be crossed out in the alert bubble and the findings panel.

Trackers | **Cookies**

Blocking **no** cookies.

When you block a cookie, selected third-party providers are unable to write cookies to your browser.

Warning! When combined with other cookie monitoring addons such as **Beef Taco**, **Cookie Monster**, and **Google Opt-Out**, this feature can cause **unresponsive script** errors. If you experience this error, please try disabling this feature or conflicting addons.

Show

Search for

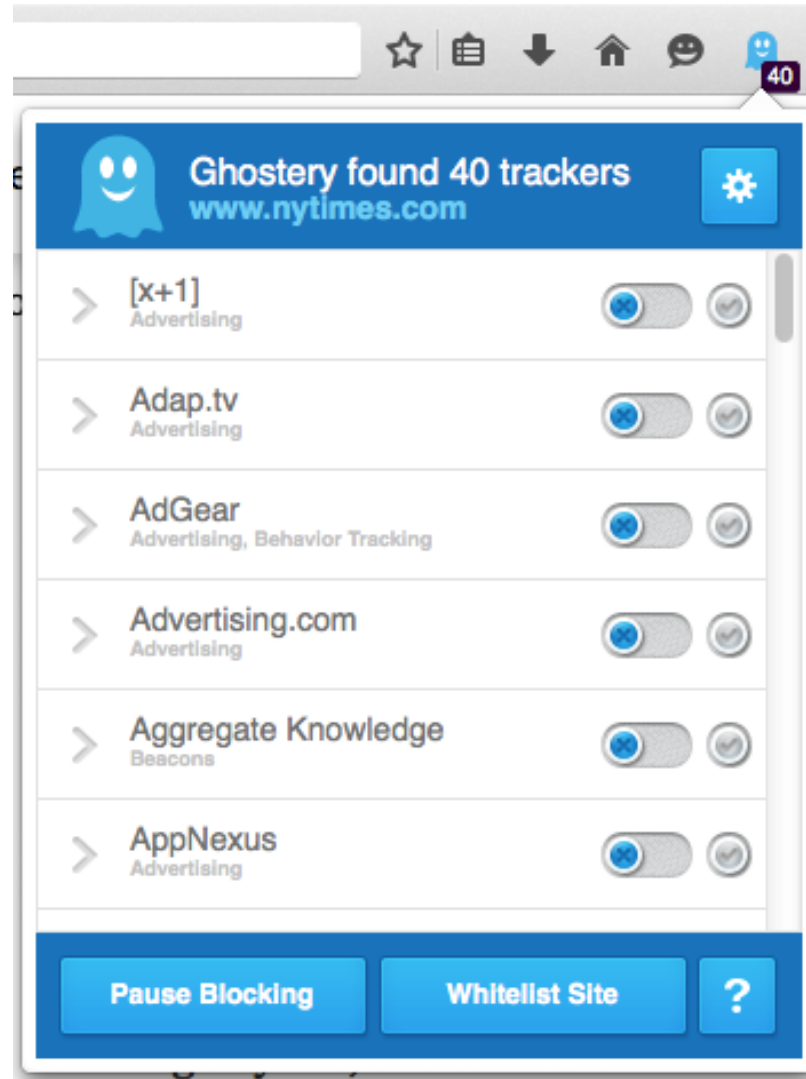
Select all | Select none | Expand all | Collapse all

>	<input type="checkbox"/>	Advertising	426 cookies: blocking none
>	<input type="checkbox"/>	Analytics	132 cookies: blocking none
>	<input type="checkbox"/>	Beacons	154 cookies: blocking none

Creates Awareness

The screenshot shows the homepage of The New York Times. At the top left, there is a navigation menu with 'SECTIONS' and 'SEARCH'. The main header features the 'The New York Times' logo and the date 'Monday, April 6, 2015'. Below the header is a navigation bar with categories like 'World', 'U.S.', 'Politics', 'New York', 'Business', 'Opinion', 'Technology', 'Science', 'Health', 'Sports', 'Arts', 'Style', 'Food', 'Home', 'Travel', and 'Magazine'. A prominent blue banner for 'The New York Times Crossword' reads 'The best puzzle in the world just got better.' Below this, the main content area features a large article titled 'G.O.P. Senator Is a Major Player in Iran Nuclear Accord' by Ashley Parker and Peter Baker. To the right of this article is a photo of a basketball being held by two hands, with the caption 'N.C.A.A. Championship: Duke vs. Wisconsin'. Further right, there is a section for 'EDITORIAL APPRECIATIONS' featuring 'Victor Gotbaum, the City's Shop Steward'. A sidebar on the right side of the page lists various advertising products, including 'Aggregate Knowledge', 'AppNexus', 'Audience Science', 'BlueKai', 'Casale Media', 'Centro', 'Chango', 'ChartBeat', 'Connexity', 'Datalogix', 'DataXu', 'DoubleClick', 'DoubleClick Floodlight', 'Dynamic Yield', 'eXelate', 'Google AdSense', 'Google Analytics', 'KruX Digital', 'LiveRamp', 'Media Optimizer (Adobe)', 'Moat', 'NetRatings SiteCensus', 'Neustar AdAdvisor', 'New Relic', 'New York Times', 'Optimax Media Delivery', 'Quantcast', 'RadiumOne', 'Rocket Fuel', 'ScoreCard Research Beacon', 'Tapad', 'TradeDesk', 'Turn', 'Twitter Advertising', 'Typekit by Adobe', and 'WebTrends'.

Unstructured Choices & Ineffective Visual Cues



Ad Industry Opt-Out Tools




Targeted Ads

The screenshot displays the MSN homepage with a search bar at the top right containing the text "bing web search". Below the search bar is a navigation bar with icons for Outlook.com, Skype, Office, OneNote, OneDrive, Maps, Facebook, Twitter, and Music. The main content area features a horizontal carousel of advertisements for Sun Joe Lawn Mowers, priced at \$149, with a "SHOP >" button. Below this is a navigation menu with categories: NEWS, WEATHER, ENTERTAINMENT, SPORTS, MONEY, LIFESTYLE, HEALTH & FITNESS, FOOD & DRINK, TRAVEL, AUTOS, VIDEO. The main content area is divided into three sections: a large image of a person mowing a lawn at sunset, a video thumbnail titled "Arnold Schwarzenegger shows off his \$2M ride" from Splash News, and another advertisement for BLACK+DECKER Lawn Mowers, priced at \$169, with a "SHOP >" button. The text "AdChoices" is visible in the bottom right corner of the advertisement area.

Ineffective Awareness

LET'S TACKLE TO DO'S.



BLACK+DECKER Lawn Mowers 20 in. 13-Amp C...
\$199

SHOP >

SHOP >

AdChoices

The image shows a promotional banner for Black+Decker lawn mowers. It features two mowers side-by-side. The one on the left is a push mower with a white deck and orange accents. The one on the right is a more compact, possibly cordless or battery-powered model, also in orange and black. Below the right mower, the text reads 'BLACK+DECKER Lawn Mowers 20 in. 13-Amp C...' followed by the price '\$199'. Both mowers have a 'SHOP >' button below them. The banner has an orange header with the text 'LET'S TACKLE TO DO'S.' and a small blue triangle icon. On the right side of the banner, there is a vertical grey bar with the text 'AdChoices' and a small blue triangle icon.

Welcome to the Digital Advertising Alliance's consumer choice page. The companies participating in this page provide transparency and choice under the [DAA Principles](#).

Some of the ads you receive on Web pages are customized based on predictions about your interests generated from your visits to different Web sites. This type of ad customization is sometimes called "[online behavioral](#)" or "[interest-based](#)" advertising. Such online advertising [helps support the free content, products and services you get online](#). The DAA Principles apply to interest-based advertising and other applicable uses of Web viewing data collected from a particular computer or device over time and across unaffiliated Web sites.

Using the tools on this page, you can opt out from the collection of Web viewing data for interest-based advertising and other applicable uses, by some or all of the participating companies.

- See all the participating companies on this choice page and learn more about their practices;
- Also find out which participating companies have currently enabled customized ads for your browser;
- Check whether you've already opted out from participating companies;
- Exercise choice with some or all participating companies, using [opt-out cookies](#) to store your preferences in your browser; or
- Use the "Choose All Companies" feature to opt out from all currently participating companies in one step. [GO](#)

 [Help with the Opt Out Page](#)

 [FAQs About the DAA](#)

 [Feedback on This Site](#)

 [Protect My Choices](#)

All Participating Companies (121) <small>SHOW</small>	Companies Customizing Ads For Your Browser (3)	Existing Opt Outs (0) <small>SHOW</small>								
<p>These 3 participating companies have enabled interest-based ads for this web browser.</p> <p>Click the company name to find out more about a participating company. To opt out from interest-based ads by one or more companies, check the box(es) in the "Select" column next to the company name(s), and then hit the "Submit your choices" button. You can also use click the "Select all shown" box to pre-check all the listed companies before you hit the "Submit" button.</p> <p>Need help?</p>	<table border="1"> <thead> <tr> <th>COMPANY NAME</th> <th>SELECT ALL SHOWN <input type="checkbox"/></th> </tr> </thead> <tbody> <tr> <td>Microsoft Advertising</td> <td><input type="checkbox"/></td> </tr> <tr> <td>Undertone</td> <td><input type="checkbox"/></td> </tr> <tr> <td>Yahoo</td> <td><input type="checkbox"/></td> </tr> </tbody> </table>	COMPANY NAME	SELECT ALL SHOWN <input type="checkbox"/>	Microsoft Advertising	<input type="checkbox"/>	Undertone	<input type="checkbox"/>	Yahoo	<input type="checkbox"/>	
COMPANY NAME	SELECT ALL SHOWN <input type="checkbox"/>									
Microsoft Advertising	<input type="checkbox"/>									
Undertone	<input type="checkbox"/>									
Yahoo	<input type="checkbox"/>									

Default Tab List the Fewer Companies

All Participating Companies (121) SHOW

Companies Customizing Ads For Your Browser (3)

Existing Opt Outs (0) SHOW

These 3 participating companies have enabled interest-based ads for this web browser.

Click the company name to find out more about a participating company. To opt out from interest-based ads by one or more companies, check the box(es) in the "Select" column next to the company name(s), and then hit the "Submit your choices" button. You can also use click the "Select all shown" box to pre-check all the listed companies before you hit the "Submit" button.

[Need help?](#)

COMPANY NAME	SELECT ALL SHOWN <input type="checkbox"/>
Microsoft Advertising	<input type="checkbox"/>
Undertone	<input type="checkbox"/>
Yahoo	<input type="checkbox"/>

Submitting your choices for the selected companies stores your opt out preference(s) in your browser. [Learn More.](#)

Extra Effort to Opt Out of More

All Participating Companies (121) Companies Customizing Ads For Your Browser (3) Existing Opt Outs (0)

SHOW SHOW

These 121 companies participate in the DAA's consumer choice page.

Click the company name to find out more about a participating company. To opt out from one or more companies, check the box(es) in the "Select" column next to the company name(s), and then hit the "Submit your choices" button. You can also click the "Select all shown" box to pre-check all the listed companies before you hit the "Submit" button. An [-] symbol in the check box indicates that you have already set an opt out for this company.

[Need help?](#)

COMPANY NAME	SELECT ALL SHOWN <input type="checkbox"/>
<i>Accuen Inc.</i>	<i>status currently unavailable</i> <input type="checkbox"/>
<i>eBay Enterprise (formerly FetchBack)</i>	<i>status currently unavailable</i> <input type="checkbox"/>
<i>Videology</i>	<i>status currently unavailable</i> <input type="checkbox"/>
33Across	<input type="checkbox"/>
Acxiom	<input type="checkbox"/>
Adara Media, Inc.	<input type="checkbox"/>
Adblade Premium Ad Network	<input type="checkbox"/>
AddThis (including XGraph)	<input type="checkbox"/>
Adelphic	<input type="checkbox"/>
Adobe Media Optimizer	<input type="checkbox"/>

Submitting your choices for the selected companies stores your opt out preference(s) in your browser. [Learn More.](#)

Submit your choices

Privacy Tools for Facebook



Just in time Intervention

Privacy Checkup Skip



Hi Charlie — Sorry to interrupt. You haven't changed who can see your posts lately, so we just wanted to make sure you're sharing this post with the right audience. (Your current setting is Public, though you can change this whenever you post.) [Learn more.](#)

Who do you want to share this post with?

 Friends	 Public	 More Options
---	--	--

Salient and Structured Notice

Privacy Settings

Invite Friends  Share 

Questions? See our FAQ!

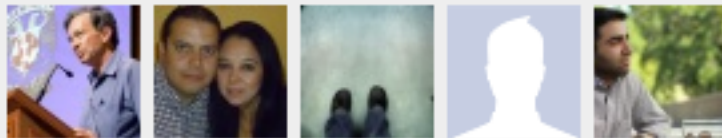
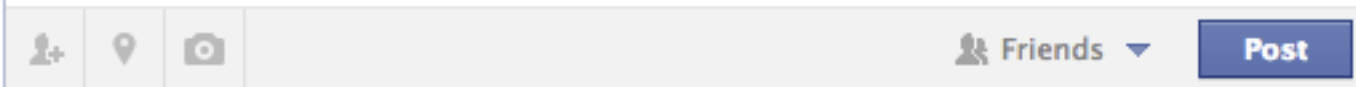


Additional Settings you should be aware of:

-  Facebook partners **can** not use your public info
-  Friends **can** share your info
-  Advertisers **can** show your info to friends in ads

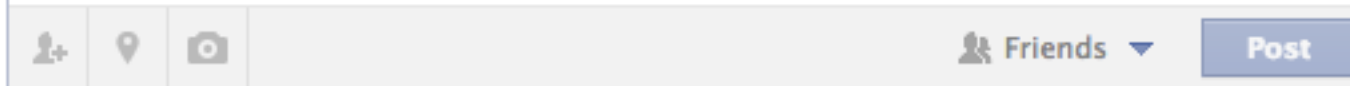
Facebook Nudges

Passive aggressive people irritate the hell out of me, if you can't say something to my face maybe you should keep your mouth shut.



These people and 102 more can see your post.

Passive aggressive people irritate the hell out of me, if you can't say something to my face maybe you should keep your mouth shut.



Your post will be published in **3 seconds**.



Improved Awareness

So I bought a Rick Pitino Makers bottle for \$50 and turned around and sold it for \$180, lol...



Public ▼

Post

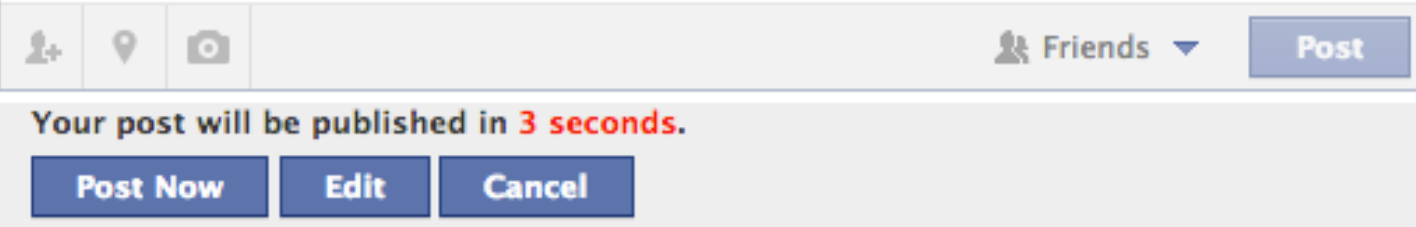


These people and ANYONE ON THE INTERNET can see your post.

“That was almost the ‘Oh wow’ moment when I realized that more people could see my posts than I thought about”

Slowed Down Participants

Congratulations to the great State of Mississippi for ratifying the 13th Amendment of the U.S. Constitution to ban slavery. Oh wait, wasn't that supposed to be done 148 years ago?








The screenshot shows the Facebook post creation interface. At the top, there are icons for adding people, location, and photos. To the right, it says "Friends" with a dropdown arrow and a "Post" button. Below this, a red timer indicates "Your post will be published in 3 seconds." At the bottom, there are three buttons: "Post Now", "Edit", and "Cancel".

“It helped me avoid getting into fights on Facebook because you have to **stop and think.**”




“I used it to correct grammatical errors or statuses that looked off.”

Assisted Decision Making






not excited about still being sick wtf

   Friends  




Your post will be published in **3 seconds**.

not excited about still being sick after spending all afternoon in bed not doing my paper or having fun.

   Friends  

Your post will be published in **3 seconds**.

Conclusions

- Behavioral biases affect privacy decision making
- Good tool design needs to take these biases into account
- Tools can both mitigate and leverage biases to assist users' decisions
- Every design choice will impact users' behavior
- Good tools can have a positive impact on users' behaviors
- Usability testing can help to assess the effectiveness of privacy tools

Thank you!

Questions?

Contact: pleon@law.stanford.edu