

Lecture 10: Online Advertising

CS 181E

Fall 2026

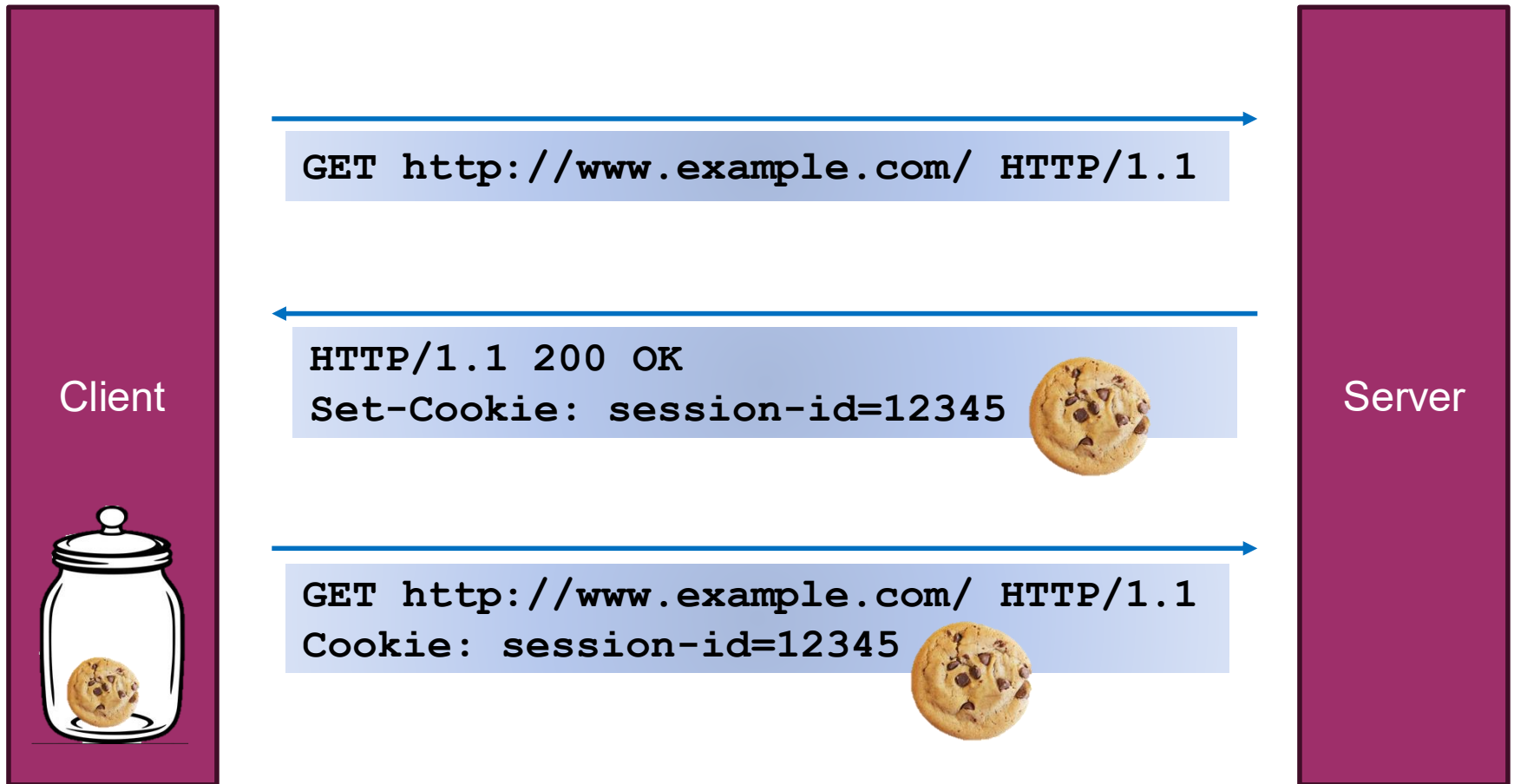
Review: Online Tracking



Review: Online Tracking



Review: Cookies



Review: Third-Party Tracking Cookies

The screenshot shows a web browser window displaying the Los Angeles Times homepage. The browser's address bar shows the URL `latimes.com`. The page features a blue header with the "Los Angeles Times" logo, a "Sections" menu, and a "Focus mode" toggle. Below the header is a blue advertisement banner for "Prime Big Deal Days" with the text "Home finds under \$30" and a "Shop now" button. The main content area displays a headline "Young people are fleeing Los Angeles for some surprising places. Fresno in, Texas out?" with a sub-headline "CALIFORNIA". Below the headline is a photograph of a man. To the right of the photograph is a section titled "Subscribers are Reading >" with a "Review" link and the text "Why this hidden gem is the new crown jewel of L.A. fine dining".

At the bottom of the browser window, a network inspector is open, showing a list of network requests. The "Name" column lists requests such as "young-people-are-fleeing-los-angeles-...", "admi", "about:blank", "about:srcdoc", "activeview", "event", and "3pEvent". The "Domain" column shows the domains for these requests, including "www.latimes.com", "web-cf-event-cell8", "pagead2.googlesyn", "prebid-a.rubiconproj", and "www.btd-cmh.tq-tu". The "Type" column shows the request types, including "document" and "fetch". The "Initiator" column shows the initiator for the fetch requests, including "ufs_web_disp...", "Bootstrap.js:2...", and "adforensics_tw...". The "Trans..." column shows the transfer size, and the "Time" column shows the response time. A yellow circle highlights the "340" value in the "Trans..." column for the "3pEvent" request.

Name	Domain	Type	Initiator	Trans...	Time
young-people-are-fleeing-los-angeles-...	www.latimes.com	document	—	—	—
admi	web-cf-event-cell8	document	—	—	—
about:blank	—	document	—	—	—
about:blank	—	document	—	—	—
about:srcdoc	—	document	—	—	—
activeview	pagead2.googlesyn	fetch	ufs_web_disp...	89 B	65.9ms
event	prebid-a.rubiconproj	fetch	Bootstrap.js:2...	125 B	78.4ms
3pEvent	www.btd-cmh.tq-tu	fetch	adforensics_tw...	44 B	157ms

Review: Trackers and Advertisers

- trackers observe user behavior across one or (usually) many sites
- use ML to make inferences about user demographics and interests
- advertisers serve ads on first or third party sites
- get paid by companies that place ads
- can choose which ads to place based on context or user attributes

Some trackers are also advertisers (e.g., Google, Meta)

Some trackers are **data brokers** who sell collected and inferred information to other third parties

Contextual Advertising

The screenshot shows the dogtrekker.com website. The navigation bar includes links for EXPLORE, PLACES TO STAY, OUTDOORS, THINGS TO DO, EVENTS, FOOD & DRINK, PET SERVICES, and NEWSLETTER. A search icon is located on the right. A banner at the top promotes 'Discover BIG BEAR LAKE' with the text 'Fall colors, dogs welcome' and a 'LEARN MORE' button. The main content area features a breadcrumb trail: Home » Beaches » Guide to the best dog parks in Southern California. The title 'Guide to the best dog parks in Southern California' is circled in yellow. Below the title is the section 'Runyon Canyon Park, Los Angeles'. The text describes Southern California as a canine playground and provides details about Runyon Canyon Park. A vertical banner on the right side of the article also promotes 'Discover BIG BEAR LAKE' with a 'LEARN MORE' button. A small circular logo with a dog's face is in the bottom right corner.

dogtrekker.com

EXPLORE PLACES TO STAY OUTDOORS THINGS TO DO EVENTS FOOD & DRINK PET SERVICES NEWSLETTER

Discover
BIG BEAR LAKE
Fall colors,
dogs welcome
LEARN MORE

SHARE

Home » Beaches » Guide to the best dog parks in Southern California

Guide to the best dog parks in Southern California

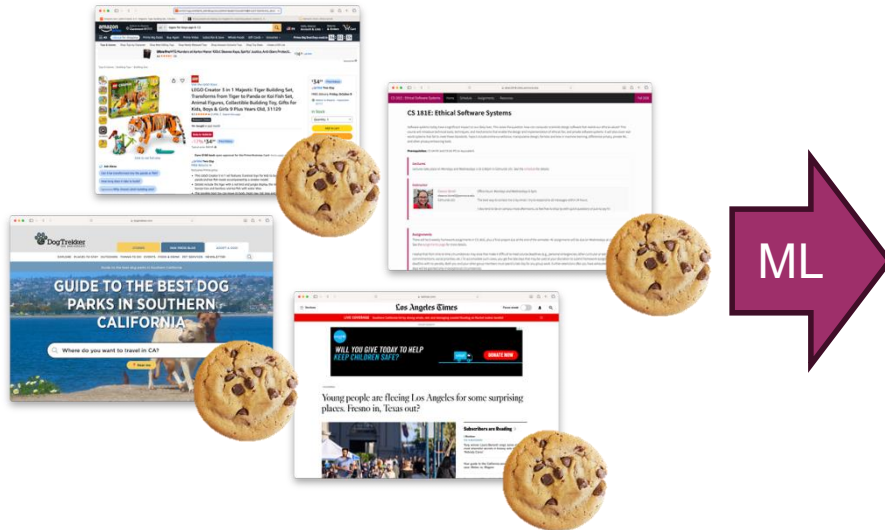
Runyon Canyon Park, Los Angeles

[Southern California](#) is a canine playground like no other — a sunny region where city sidewalks quickly give way to sandy beaches, winding trails and inviting green spaces. This guide takes dog lovers on a tour of some of the best dog parks from Los Angeles down to San Diego, exploring urban favorites, oceanfront escapes and mountain vistas perfect for adventurous pups.

Starting high in the Hollywood Hills at [Runyon Canyon Park](#), early risers and their dogs can trek rugged trails to panoramic views of Los Angeles. Here, a 160-acre natural playground unfolds, offering winding paths, sagebrush scents and clear signage to designate off-leash zones. Keep an eye out for local wildlife, carry extra water and enjoy this natural wilderness tucked within the city.

Discover
BIG BEAR LAKE
LEARN MORE

Targeted Advertising



Your categories

Below you can review the interests and inferred demographics that Google has associated with your cookie. You can [remove](#) or [edit](#) these at any time.



Business & Industrial

Business & Industrial - Manufacturing

Computers & Electronics - Computer Hardware - Laptops & Notebooks - Tablet PCs

Computers & Electronics - Software - Multimedia Software - Photo & Video Software

Computers & Electronics - Software - Operating Systems - Mac OS

Internet & Telecom - Mobile & Wireless - Mobile Phones

Internet & Telecom - Mobile & Wireless - Mobile Phones - Smart Phones

Online Communities - Social Networks

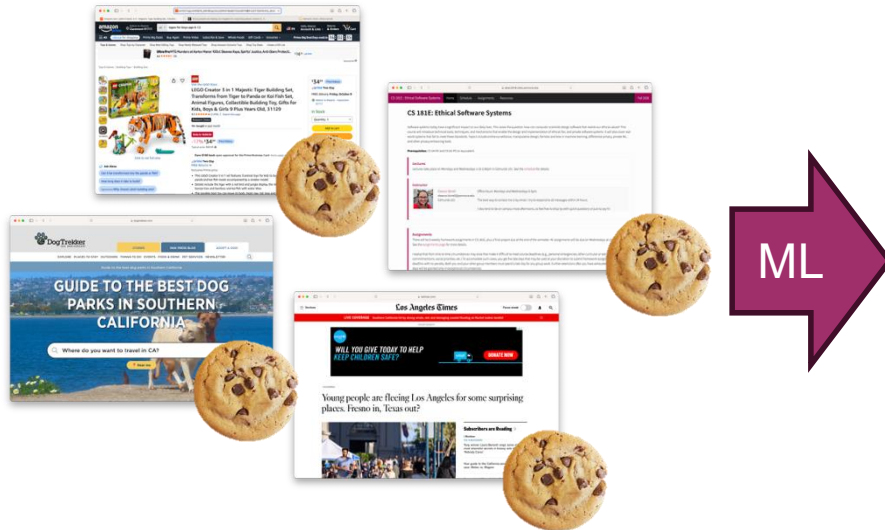
Reference - General Reference - Time & Calendars

Science - Mathematics

Exercise: Targeted Ads

- Go to Google's Ad Center:
<https://myadcenter.google.com/controls>
 - What demographic info are they using to target ads to you?
 - What categories are they using to target ads to you?
 - What activity are they using to target ads to you?
- Go to Meta's Privacy Center:
<https://accountscenter.instagram.com/ads/>
 - What categories are they using to target ads to you?
 - Are they using activity info from 3rd parties?

Targeted Advertising



Your categories

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Business & Industrial

Business & Industrial - Manufacturing

Computers & Electronics - Computer Hardware - Laptops & Notebooks - Tablet PCs

Computers & Electronics - Software - Multimedia Software - Photo & Video Software

Computers & Electronics - Software - Operating Systems - Mac OS

Internet & Telecom - Mobile & Wireless - Mobile Phones

Internet & Telecom - Mobile & Wireless - Mobile Phones - Smart Phones

Online Communities - Social Networks

Reference - General Reference - Time & Calendars

Science - Mathematics

Audience Segments

Suggest who should see your ads. You can create new segments in [Audience Manager](#).

Edit targeted segments

Done

Search

Browse

None selected

Clear all



What their interests and habits are

Select one or more segments to target.

Affinity



☐ Banking & Finance



☐ Beauty & Wellness



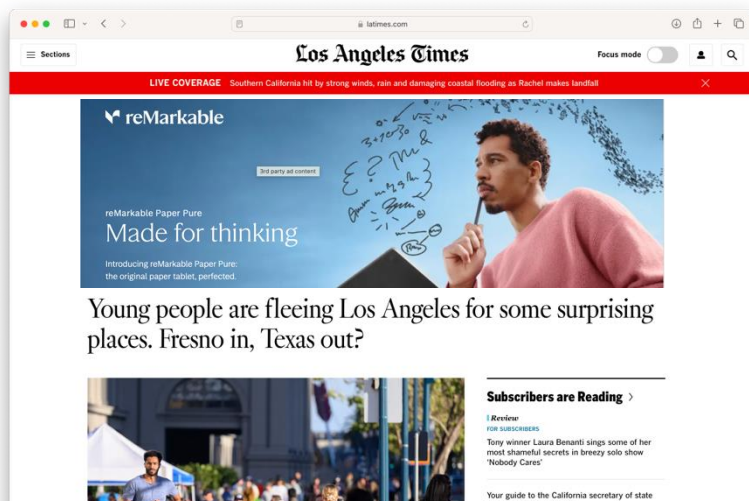
☐ Food & Dining



☐ Home & Garden



☐ Lifestyle & Hobbies



Advertising Targets

Audience Segments



Suggest who should see your ads. You can create new segments in [Audience Manager](#). [?]

Edit targeted segments		Done
Search	Browse	None selected Clear all
Who they are (Detailed demographics)	>	Select one or more segments to target.
What their interests and habits are (Affinity)	>	
What they are actively researching or planning (In-market and life events)	>	
How they have interacted with your business (Your data segments)	>	
Your combined audience segments (Combined segments)	>	

Demographic Targeting

Audience Segments

Suggest who should see your ads. You can create new segments in [Audience Manager](#).

Edit targeted segments

Done

Search

Browse

None selected

Clear all

← Who they are

Select one or more segments to target.

Parental Status

Parents

☐ Parents of Infants (0-1 years)

☐ Parents of Toddlers (1-3 years)

☐ Parents of Preschoolers (4-5 years)

☐ Parents of Grade-Schoolers (6-12 years)

☐ Parents of Teens (13-17 years)

× Edit demographics

Ad group: Website traffic-Search-1 > Ad group 1

Gender

Age

Household income

☒ Female

☒ 18 - 24

☒ Top 10%

☒ Male

☒ 25 - 34

☒ 11 - 20%

☒ Unknown

☒ 35 - 44

☒ 21 - 30%

☒ 45 - 54

☒ 31 - 40%

☒ 55 - 64

☒ 41 - 50%

☒ 65+

☒ Lower 50%

☒ Unknown

☒ Unknown

Interest Targeting

Audience Segments

Suggest who should see your ads. You can create new segments in [Audience Manager](#). ?

Edit targeted segmentsDone

SearchBrowse

← What their interests and habits are

Affinity

☐ Banking & Finance

☐ Beauty & Wellness

☐ Food & Dining

☐ Coffee Shop Regulars

☐ Cooking Enthusiasts

☐ 30 Minute Chefs

None selectedClear all

Select one or more segments to target.

Recent History Targeting

Audience Segments

Suggest who should see your ads. You can create new segments in [Audience Manager](#). ?

Edit targeted segmentsDone

SearchBrowse

None selectedClear all

← What they are actively researching or planning

In-market

Life events

☐ Business Creation

☐ College Graduation

☐ Job Change

☐ Marriage

☐ Moving

Select one or more segments to target.

Exercise: Problematic Targeting

- What are examples where targeting particular ads at particular people might be problematic?

Targeting Housing Ads (2016)

Boost Post

AUDIENCE

☐ People you choose through targeting

☐ NYC Housing Market

☒ Housing Market NYC [Edit](#)

✓

Your audience selection is **great!**

Location - Living In: United States: New York

Age: 18 - 65+

Exclude: Behaviors: Asian American (US), African American (US) or Hispanic (US - Spanish dominant)

People Who Match: Interests: Buying a House, First-time buyer or House Hunting, Behaviors: Likely to move

[Less](#)

☐ HOUSING MARKET NYC

☐ New York City Housing Market

[See All \(8\)](#) | [Create New Audience](#)

BUDGET AND DURATION

Total budget ⓘ

\$5.00 USD

▼

 By clicking Boost, you agree to Facebook's [Terms & Conditions](#) | [Help Center](#)

Cancel

Boost

DESKTOP NEWS FEED

MOBILE NEWS FEED

 **Housing Agency New York City** shared your [Marketplace post](#).

Sponsored · 

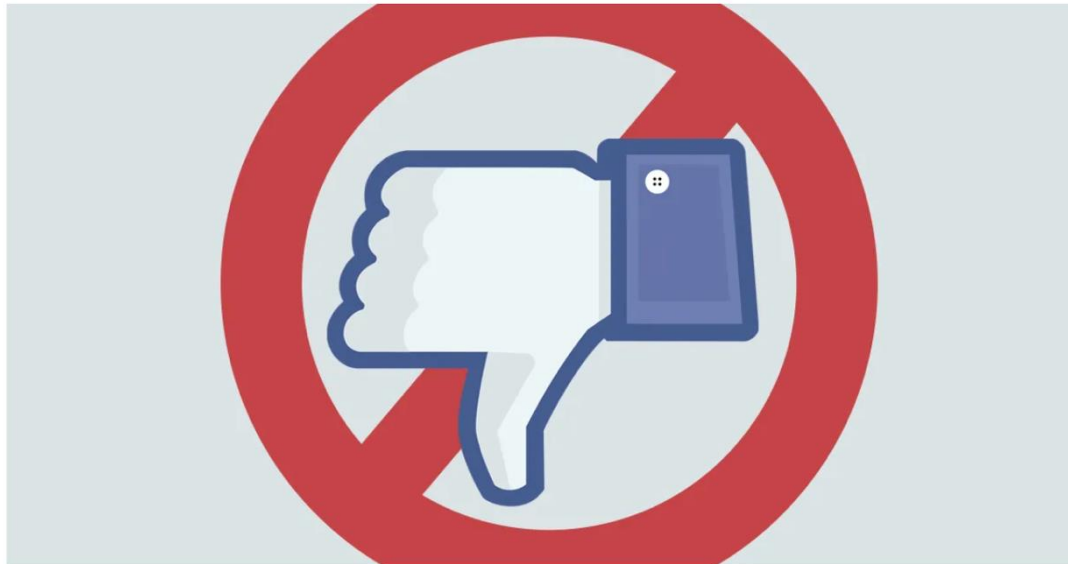
Great up and coming neighborhood. More studio and 1 bedrooms for rent. Inquire within!



Facebook Response

Facebook Says it Will Stop Allowing Some Advertisers to Exclude Users by Race

Facebook says it will build a system to prevent advertisers from buying credit, housing or employment ads that exclude viewers by race.



by **Julia Angwin**

November 11, 2016, 10:00 am

2017 Update

Facebook (Still) Letting Housing Advertisers Exclude Users by Race

After ProPublica revealed last year that Facebook advertisers could target housing ads to whites only, the company announced it had built a system to spot and reject discriminatory ads. We retested and found major omissions.



Facebook CEO Mark Zuckerberg speaks in San Jose, California, in October 2016. DAVID PAUL MORRIS/BLOOMBERG VIA GETTY IMAGES

by [Julia Angwin](#), [Ariana Tobin](#) and [Madeleine Varner](#)

November 21, 2017, 1:23 pm

Job Ads (2017)

verizon **Verizon Careers**
Sponsored · 

Here, your more than just a number. Practice data story-telling, analytics, and more.



Verizon FP&A careers
Stay on top of your game

WWW.VERIZON.COM

[Learn More](#)

- identified dozens of employers targeting ads at young adults
- Verizon, Amazon, Goldman Sachs, Target, Facebook
- likely violation of federal law

One reason you're seeing this ad is that **Verizon Careers** wants to reach people interested in **Finance**, based on activity such as liking Pages or clicking on ads.

There may be other reasons you're seeing this ad, including that Verizon Careers wants to reach **people ages 25 to 36 who live or were recently near Washington, District of Columbia**. This is information based on your Facebook profile and where you've connected to the internet.

Job Ads (2018)

Facebook Is Letting Job Advertisers Target Only Men

by Ariana Tobin and Jeremy B. Merrill

September 18, 2018, 6:39 pm

2019 Update

Facebook Ads Can Still Discriminate Against Women and Older Workers, Despite a Civil Rights Settlement



by Ava Kofman and Ariana Tobin

December 13, 2019, 5:00 am

Federal Settlement (2022)

Facebook Finally Agrees to Eliminate Tool That Enabled Discriminatory Advertising

Six years after ProPublica revealed that Facebook allowed advertisers to exclude Black users and others, the company agreed to a settlement with the Justice Department to overhaul its ad algorithm system.

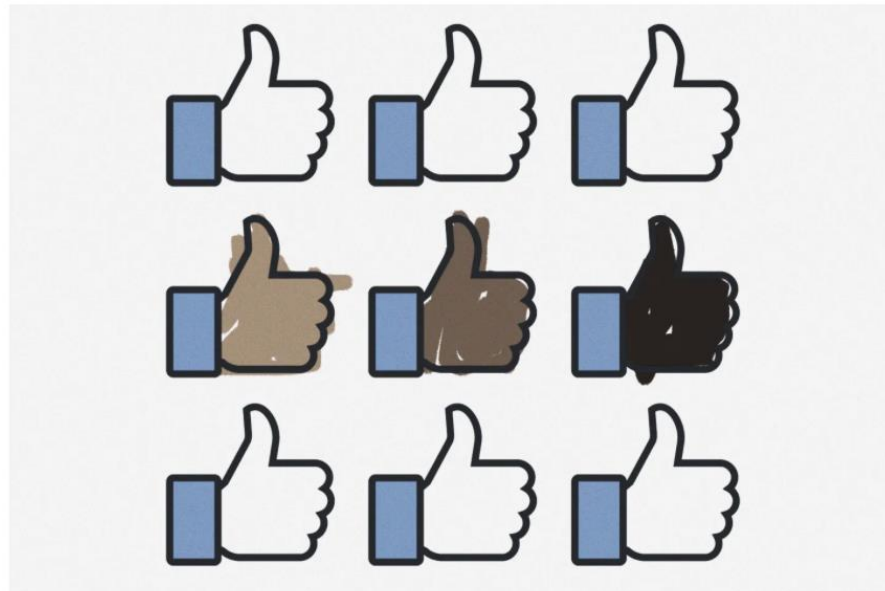


ILLUSTRATION BY PROPUBLICA



by Ariana Tobin and Ava Kofman

June 22, 2022, 4:30 pm

Exercise: Problematic Targeting

- How might an advertiser target ads in a problematic way if they're not allowed to target protected attributes?

Disparate Impact

- Defining advertising discrimination:
 1. ~~Intent:~~ the advertiser is trying to benefit one group over another
 2. ~~Process:~~ the advertiser targets or excludes specific groups
 3. **Outcome:** different groups are more or less likely to see the ad

Attribute-Based Targeting

- advertisers select specific demographics or interests
- can select other attributes that correlate

Free-form Attribute	Potential Target (PT)	PT Audience (%)	US Audience (%)
Marie Claire	Female	90%	54%
myGayTrip.com	Man interested in Man	38.6%	0.38%
BlackNews.com	African American affinity	89%	16%
Hoa hoc Tro Magazine	Asian American affinity	95%	3.4%
Nuestro Diario	Hispanic affinity	98%	16%

Topic	Free-form attributes
Religion	Islam (5.7M), Catholic Church (6.5M), Evangelicalism (5.6M)
LGBT	LGBT community(21M), Gay pride (13M), Same-sex marriage(4.2M)
Vulnerable people	Addicted (100K), REHAB (450K), AA (50K), Support group (610K)

Custom Audience Targeting

- advertisers can specify target individuals by phone number or email address
- advertising platforms do not audit lists for shared protected attributes
- voter registration records include age (38 states), gender (34 states), race (8 states)
- these attributes can also be inferred
 - gender from name ~96% accurate
 - race from name ~91% accurate

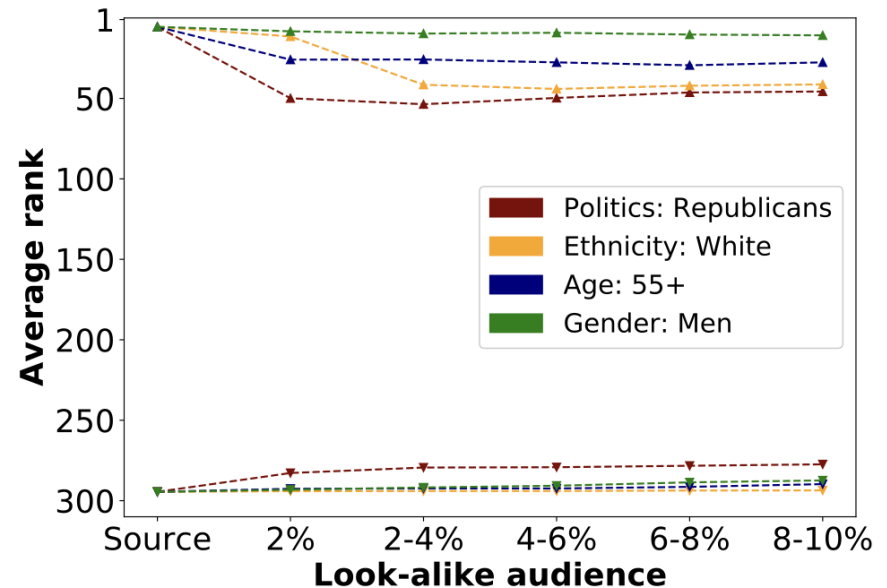
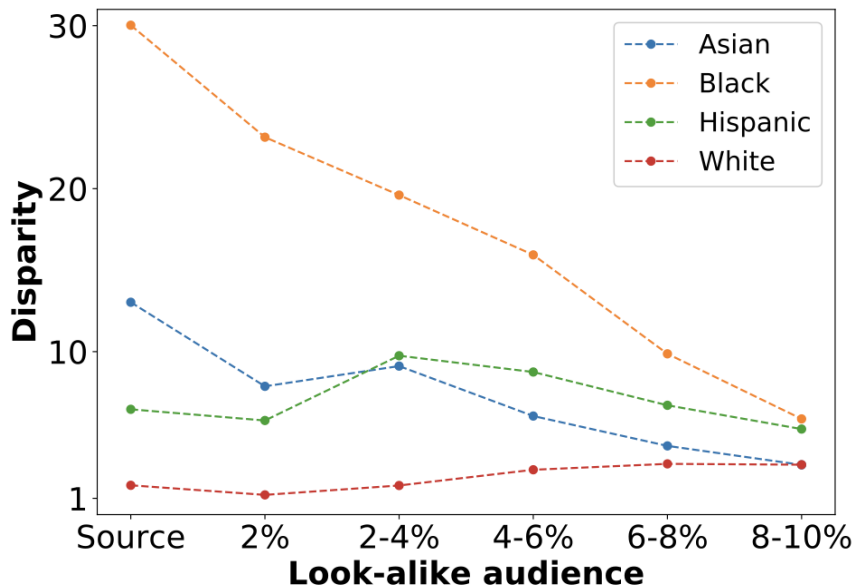
Look-Alike Targeting

- advertisers can target people who are similar to existing set of customers (defined by PII)
- biases in source audience extend to look-alike audience

Over-represented Attributes	Under-represented Attributes
Source Audience	
African American affinity (5.52)	Asian American affinity (0.09)
US politics: very liberal (3.21)	Hispanic (Spanish dominant) affinity (0.09)
Liberal content engagement (2.98)	Expats: Mexico (0.11)
Interest: Gospel music (2.64)	Hispanic (all) affinity (0.18)
Interest: Dancehalls (2.51)	Expats: all countries (0.22)
2% Look-Alike Audience	
African American affinity (5.24)	Hispanic (Spanish dominant) affinity (0.10)
Liberal content engagement (4.16)	Expats: Mexico (0.13)
US politics: very liberal (3.29)	Asian American affinity (0.13)
Interest: Gospel music (3.07)	Hispanic (all) affinity (0.19)
Interest: Soul music (2.32)	Expats: all countries (0.24)
2–4% Look-Alike Audience	
African American affinity (5.06)	Asian American affinity (0.17)
Liberal content engagement (3.61)	Hispanic (Spanish dominant) affinity (0.18)
US politics: very liberal (3.37)	Expats: Mexico (0.19)
Interest: Gospel music (2.72)	Hispanic (all) affinity (0.29)
Interest: Dancehalls (2.54)	Expats: all countries (0.37)

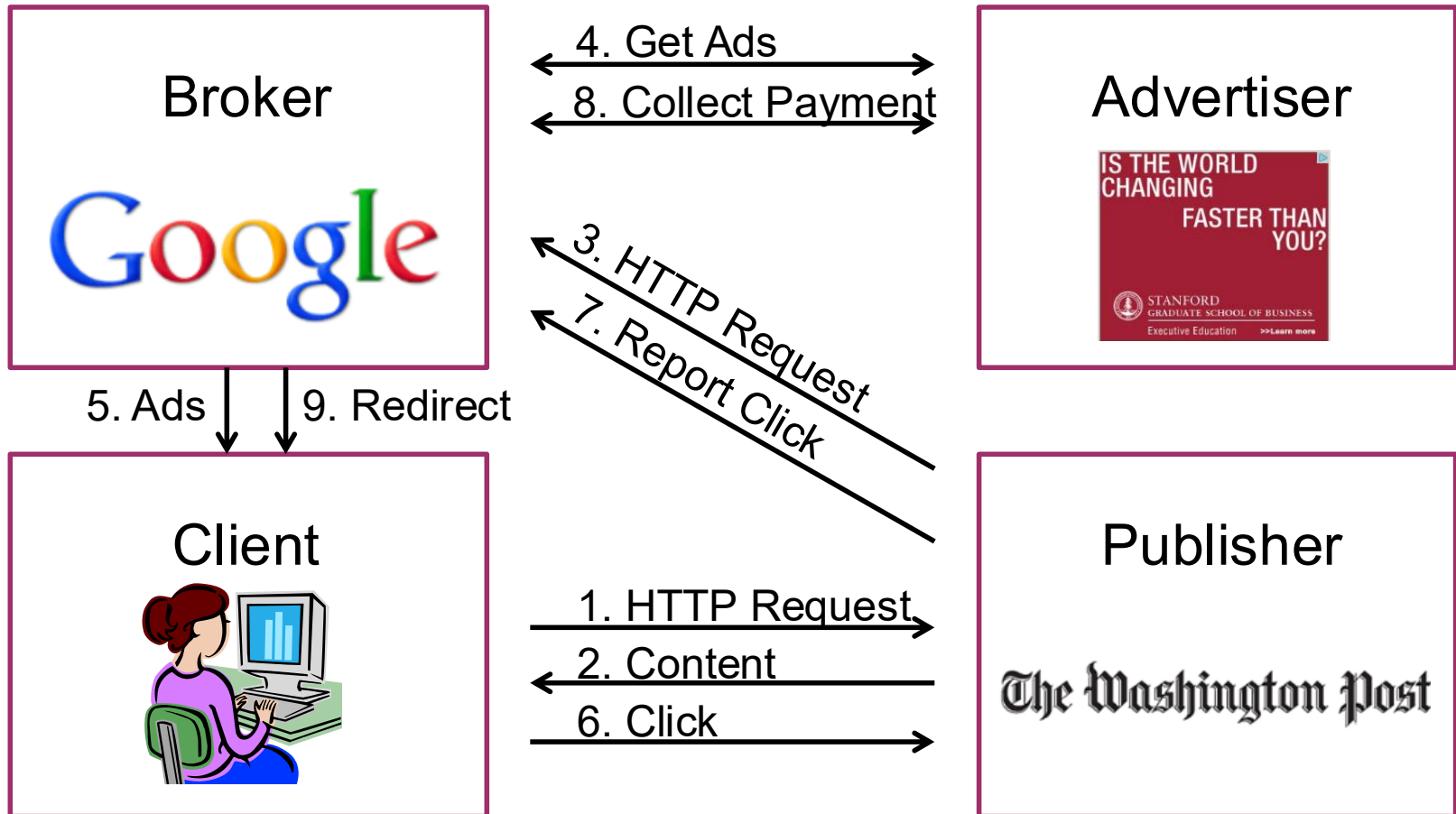
Look-Alike Targeting

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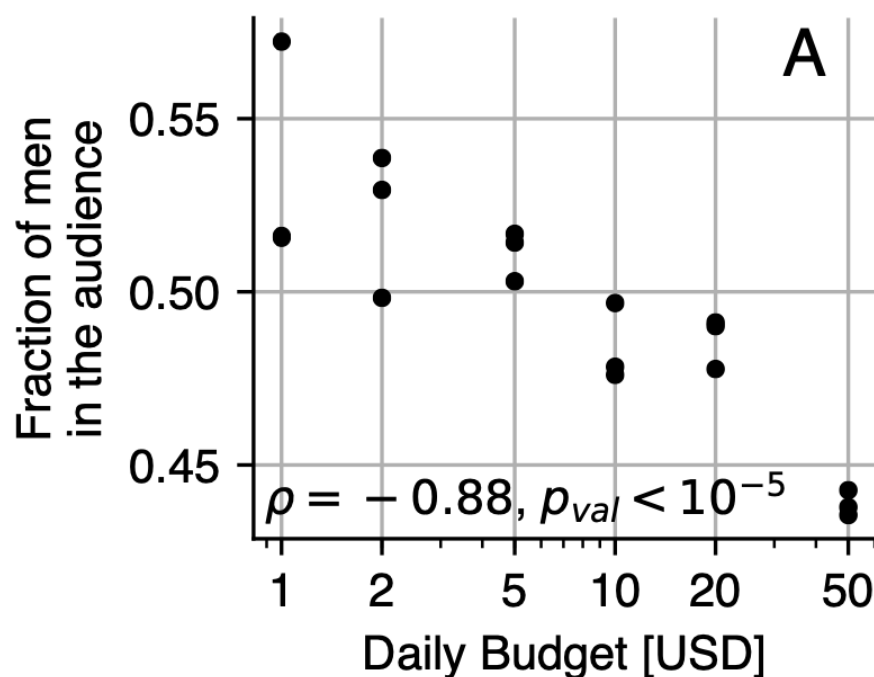
What if the advertiser isn't trying to discriminate?

Online Advertising

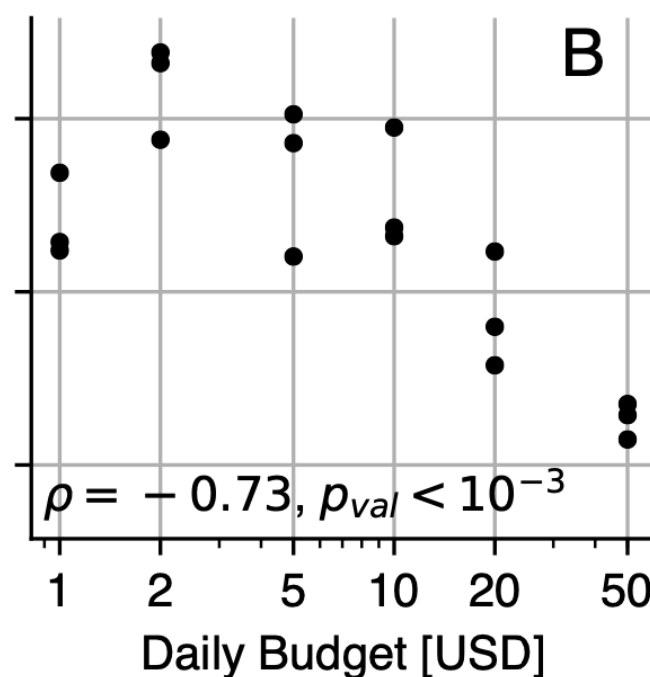


The Effect of Market Effects

- Ad placement determined by auction



General Audience



Custom Audience

The Effect of Ad Content

Fashion Folk
Sponsored · 🌐

1 Try these 9 muscle gaining tips to combat your fast metabolism and achieve the mass you want!

2 

3 BODYBUILDING.COM

4 **9 Killer Ways To Gain Muscle Naturally!**

5 Tired of being known as the 'skinny guy' ? Then try th...

2 Shares

Like Comment Share

Fashion Folk
Sponsored · 🌐

1 Find out what essentials build the makeup kits of celebrity makeup artists.

2 

3 ELLE.COM

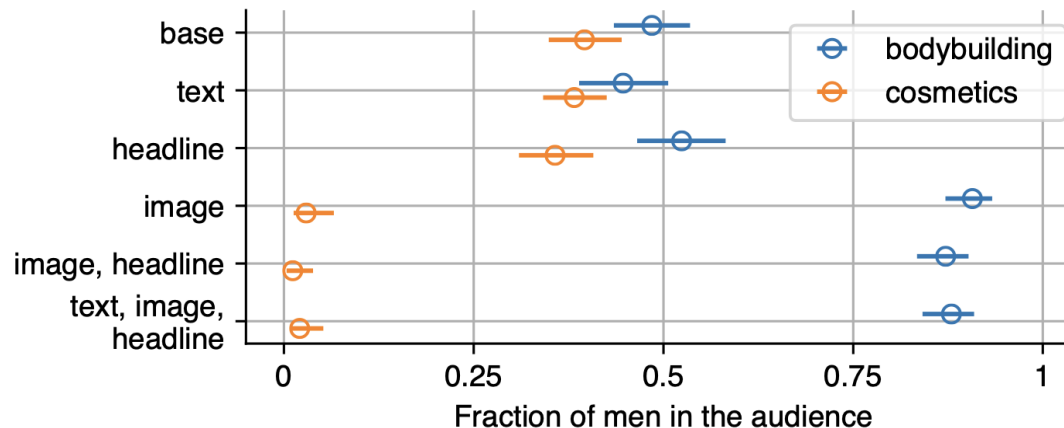
4 **How to Build a Makeup Kit, According to Three Celebrity Makeup Artists**

5

1 Like 1 Comment

Like Comment Share

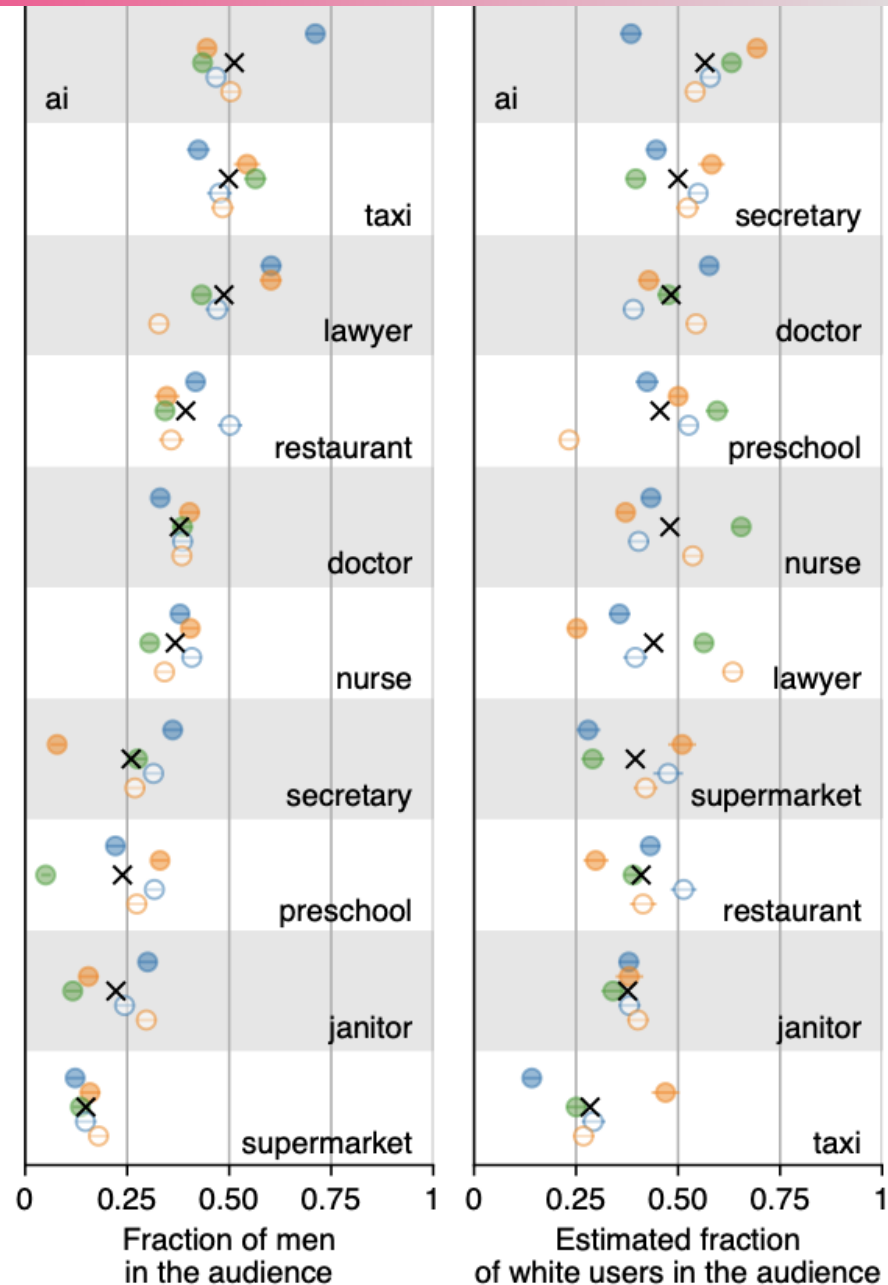
- 1 text
- 2 image
- 3 base url
- 4 headline



Real-world Effects

- different jobs end up with different audience demographics
- in some cases, image significantly affects audience

× average
 ● Black man
 ● Black woman
 ● neutral
 ● white man
 ● white woman



Real-world Effects

- different housing ads end up with different audience demographics

