

Digital Billboards Are Tracking You. And They Really, Really Want You to See Their Ads.

How the most intrusive parts of the web are expanding into the real world, complete with data collection and targeted ads

By Thomas Germain
November 20, 2019



CR privacy and technology reporter Thomas Germain in New York City's Times Square, a moment after his photo was triggered on a billboard across the street.

On a bright Friday morning, Frank O'Brien is giving me a tour through Times Square in New York City. Thousands of strangers are milling around us on the sidewalk, and in the crowd, it's easy to feel anonymous. But according to O'Brien, many of the billboards and screens towering over our heads in every direction know a lot about who we are.

“As we stand here, there are devices behind that screen that are picking ID numbers from our cell phones,” O'Brien tells me, gesturing toward a billboard at 42nd Street and 7th Avenue. Using those devices and other technology, he says, “We know who is in Times Square at a given moment.”

O'Brien, the CEO of a high-tech advertising platform called Five Tier, launches an app on his phone. He taps a few buttons and in an instant, the billboard changes to display a picture of me I'd sent him the day before. Suddenly, I'm famous, with a 20-foot-high photo of me gazing out over the tourists. "It still amazes me sometimes," he says.

Five Tier doesn't typically change the content manually. In practice, automated systems update the ads in real time based on a stream of data from nearby cell phones, which is combined with personal information on those passersby from data brokers who trade in the details of consumers' lives.

When we go out into public, we are often surrounded by screens showing ads. They can be on the side of the road, at the gym, in store windows, in doctors' offices, and in elevators. You might assume that the marketing messages are playing on a loop, but sometimes these ads are changing because people like you are nearby.

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Data including your gender, age, race, income, interests, and purchasing habits can be used by a company such as Five Tier to trigger an advertisement right away. Or, more often, it will

be used for planning where and when to show ads in the future—maybe parents of school-age children tend to pass a particular screen at 3 p.m. on weekdays, while 20-something singles usually congregate nearby on Saturday nights.

Then the tracking continues. Once your phone is detected near a screen showing a particular ad, an advertising company may follow up by showing you related ads in your social media feed, and in some cases these ads may be timed to coordinate with the commercials you see on your smart TV at night.

It doesn't stop there. Advertisers are keenly interested in "attribution," judging how well a marketing campaign influences consumer behavior. For instance, is it better to target people like you with online ads for fast food right after you see a restaurant's new TV commercial, or to wait until after you drive by a new billboard the next day? The advertising industry looks for the answers by watching where you go in person, what you do online, and what you buy with your credit card.

These aren't futuristic scenarios. They are a recent but growing trend, according to executives in the advertising business. "The industry has really started to wake up to this within the last year," says Ian Dallimore, the director of digital growth for Lamar Advertising, a leader in out-of-home advertising. "If you're not using data to better plan and buy ads, then you're probably not doing out-of-home the right way."

Researchers say that as tracking and ad targeting spill over from the web into the real world, our collective privacy and sense of control are eroding. If you don't want to see ads at

home, you can close your browser or turn off your phone, but you can't avoid the ads you see in public. And there's no practical way to completely block the location tracking used to place those ads.

"Advertising has been increasingly interested in using behavioral psychology to nudge people in particular ways," says Matthew Crain, assistant professor of media and culture at Miami University in Oxford, Ohio. "The ability to gather data on what we do and how we move through the world makes that more effective. It raises new questions about the lines between persuasive advertising and manipulation."

The out-of-home market provides a fresh window into how consumer data is being used by advertisers. Soon it seems, almost every part of your life may be just another data point for marketing clients to consider and another opportunity to monetize your attention by showing you an ad.

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Hey, I Spotted You at Kohl's.
Wanna See a DSW Billboard?

Out-of-home advertising covers everything from old-fashioned billboards to the little TV screens on the sides of gas pumps. Until recently, the companies that handled these ads only thought about competing with each other, says François-Xavier Pierrel, chief data officer at JCDecaux, a global leader in the industry. But as targeted advertising took over the web, that changed—clients started to expect more data, and more personalization. "We had to step up," Pierrel says.

Today, the out-of-home advertising business is adopting the model that runs ads on the web, with more ads being sold

based on granular details about the audiences that will be exposed to them.

Last summer, Lamar Advertising helped the shoe retailer DSW use out-of-home screens to promote the grand opening of a new store at a mall in Mount Prospect, Ill., a suburb northwest of Chicago. The company found consumers to target through “geofencing,” using location-tracking technology to sniff out cell phones that entered competing stores, such as Kohl’s, Macy’s, Marshalls, and Nordstrom Rack. The owners of those phones would be good prospects, so Lamar used geofencing at screens around town, waiting until enough of those phones were detected nearby, and then automatically triggering ads for the DSW store.

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“It’s happening everywhere,” says Lamar’s Dallimore. “As the data changes, we’re changing the creative in real time.”

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Later, the company wanted to measure how many people who were exposed to the DSW advertisements went to the new store. Using location tracking, Lamar estimated that 442 people walked into the DSW as a result of the ads.

Out-of-home ad networks typically don’t learn the names or email addresses of individuals, but the data they receive can feel highly personal.

Back at Five Tier’s office in midtown Manhattan, O’Brien shows me the system that runs the company’s advertising platform. One tab he pulls up displays a list of mobile devices that are currently in Times Square. Another shows the number of 18- to 24-year-old women in range of a particular set of screens in Germany. A third loads metrics from an ad campaign for a car dealership in Oklahoma, laying out the

genders, ages, races, credit scores, income levels, and lifestyles of people seen in the area at different times of the day.

“We want data as fast as it’s available,” O’Brien says. “We have some that’s coming in every second.”



Out-of-home advertising networks operated by companies such as Five Tier allow clients to use online dashboards to (clockwise from upper left) set up ad campaigns; look for digital billboards where their ads can be shown; and learn details about frequent passersby, such as their race, credit score, income, and interests.

Would-be clients can bid on out-of-home advertising slots by using automated platforms operated by Five Tier, JCDecaux, Lamar, and other companies. And more big tech companies are moving into this business—Google confirmed to Consumer Reports that it is starting to experiment with out-of-home advertising.

You can glimpse the potential scale of the out-of-home advertising industry courtesy of a firm called Adomni, headquartered in Las Vegas. Type your city into the company's website, and a list appears with all the screens where Adomni can serve an ad. There are tens of thousands of them in the U.S. On a recent day, you could play 15-second ads in Times Square for just over \$10 a pop, while 42-and-a-half cents bought the same screen time on a highway billboard near Citi Field, home of the New York Mets. In Mount Prospect, Ill., ad time on a network of screens in doctor's office waiting rooms cost about a quarter.

Out-of-home ad companies don't need to own the screens they use, and often they don't. Any display connected to the internet can be hooked up to an advertising network. "Think of us as the pipes," says Jonathan Gudai, Adomni's CEO. "Screens are popping up everywhere around us. As long as it's in a high enough traffic area, then it's a good candidate to be listed on our platform and monetized."

Tag—You're a Prospect

Out-of-home advertising relies on a tangled web of companies that collect, analyze, and trade information about consumers. "We do not produce any mobile data ourselves," JCDecaux's Pierrel says. "We buy it from third parties."

One location data broker that specializes in out-of-home advertising is PlaceIQ. The company pairs location data collected from software embedded in all kinds of mobile apps with additional details sourced from other data brokers to create a detailed picture of the people passing through an area.

Location data brokers can generate some details based on physical tracking alone—where you shop, work, or attend church can say a lot that's of interest to advertisers. PlaceIQ says it also uses outside sources to gather information such as your recent purchases, driving habits, and what you watch on TV. The company's list of data partners includes companies such as Experian, Mastercard, and Nielsen Catalina Solutions. (PlaceIQ did not respond to Consumer Reports' request for comment.)



Bluetooth beacons (left) and WiFi sniffers are placed in many public areas, including shopping centers and malls, to determine which smartphones—and their owners—are nearby. A number of marketing companies use these devices to plan advertising, while others rely on data collected and shared by mobile apps.

Here's how it works. A location data broker may gather data streaming off mobile apps on your phone and record the fact that you go to the gym twice a week. Other companies may

know that you frequently use your credit card at natural-foods grocery stores and that you subscribe to a running magazine. Later, when a food manufacturer wants to promote its new organic protein bar, the advertising firm it hires can target you for a marketing campaign, along with lots of others consumers—who have all been tagged as health fanatics.

The location-tracking part of that process depends on one piece of technology not owned by the data companies: your smartphone.

“I would expect that almost everyone has at least one app on their phones that sends location data to third parties,” says Serge Egelman, a digital security and privacy researcher at the University of California, Berkeley, who studies how apps gather consumer data.

“Your device is constantly broadcasting unique identifiers,” Egelman says. For instance, your phone transmits Bluetooth and WiFi MAC addresses to help it discover and communicate with wireless networks and other devices. Some location brokers make use of small, inconspicuous devices that can pick those numbers out of the air to identify the phones that wander by. These devices are scattered across public spaces. (You may be sitting near one right now.)

However, Apple and Google, the maker of the Android operating system, have recently taken steps to make it harder for phones to be tracked this way.

Targeted Ad, or Just a Billboard?

In the advertising industry, some people are concerned about a privacy backlash, even as personalization is making ads

more relevant and useful to consumers.

“We are moving towards a world in which advertising will essentially follow us around based on data from our phones or other devices,” says Jeremy Katz, worldwide editorial director for Ogilvy, one of the world’s leading advertising agencies. “But I don’t think we’ve decided as a society whether or not that’s how we want our world to look.”

Several out-of-home advertising insiders echoed those concerns. It would be easy for companies to target ads in public directly at individuals, several executives told me, but for now, that isn’t happening. That’s partly because it’s not cost-effective but also because it might feel creepy. “For us it’s about transparency,” Lamar’s Jan Dallimore says. “Our biggest thing is making sure we’re not being too specific to an individual.” <https://powcoder.com>

Companies such as Adomni, Five Tier, JCDecaux, and Lamar emphasize that they don’t learn identifying details such as the names, email addresses, or phone numbers of the people whose data flows across their screens. And most of the information is aggregated—they want to know how many people of a certain target audience are present at a particular time, not who each individual is. They don’t need that information to plan ad placements and to keep the revenue flowing.

Still, the data that fuels advertising systems, online and offline, is highly personal. “I guess I’m glad they’re not specifically interested in me as an individual, but the privacy violation is the same,” says Justin Brookman, who directs privacy and security policy at Consumer Reports. “The data collection and sharing is still happening.”

Lawmakers and regulatory agencies such as the Federal Trade Commission are paying more attention to data privacy, but it's not clear how the measures being put in place will affect the way individuals are tracked through their phones, and how the data is used by data brokers and their clients. Several out-of-home advertising companies I spoke with said they already comply with GDPR, Europe's sweeping privacy regulation that was implemented in 2018. The companies also say they are prepared for the most stringent privacy legislation in the U.S., the California Consumer Privacy Act, which is supported by Consumer Reports and goes into effect in January 2020.

Five Tier's Frank O'Brien says that, just like every other industry, the out-of-home advertising business should be regulated. But for now, if you're not comfortable with how out-of-home advertising uses your information, you don't have much recourse. "I don't think there's anything you can do about it," he says.

In the meantime, out-of-home advertising is charging ahead. Last summer, Adomni ran a campaign for the Ultimate Fighting Championship based on the daily travel patterns of consumers singled out as potential fans. Over the past year in Buffalo, N.Y., Lamar targeted consumers exposed to out-of-home advertising for Tim Hortons restaurants with additional ads on their mobile devices. And in Times Square, Five Tier helped promote an event by a Sikh religious organization by playing ads when the target demographic was nearby.

If this kind of geofencing and ad targeting bothers you, you can adjust the location permissions on your phone to limit which apps have access to your GPS data, and delete as many apps as possible. You can put your device on airplane mode,

or even leave it at home. That will all make a difference, but you can't opt out entirely if you like using 21st century technology.

Recently, I was heading home after meeting a friend for dinner. I'd been thinking about selling my old Samsung Galaxy phone, and as I approached a screen on the side of a bus stop, a new ad popped up, promoting used cell phones on eBay. Was the ad triggered because I was there and I'd been researching how much I could get for my used phone in recent weeks? Had some advertising company noticed that eBay shoppers tended to pass by this corner around 8 p.m. on Thursdays? Or was the ad just playing on a loop?

The internet has long since changed the way we access information and communicate with each other, and today it's altering the way we experience the physical world. As companies fight for your attention, you can probably feel it all happening, but for most people, the details are just out of reach.