Sensitive Inferences in Targeted Advertising

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SENSITIVE INFERENCEs IN TARGETED ADVERTISING

Sarita Schoenebeck, Cami Goray, Amulya Vadapalli & Nazanin Andalibi
SENSITIVE INFERENCES IN TARGETED ADVERTISING

Sarita Schoenebeck,* Cami Goray,† Amulya Vadapalli‡ & Nazanin Andalibi§

ABSTRACT—People’s data is scattered around the Internet. From the meals we eat to the people we meet, we leave detailed data traces online that are then aggregated, modeled, brokered, and sold. Some data types, like medical records or religious beliefs, are legally protected, restricting how they can be collected and used. However, most data has little regulatory protection. Regardless of whether data is protected, most inferences—predictions about people’s identities, attitudes, or interests using machine learning—have even fewer protections. This is a concern for our privacy, dignity, and wellbeing, especially when inferences are sensitive, personal, or intimate in nature.

This article examines people’s comfort with sensitive inferences in the context of the most sophisticated inference ecosystem on the Internet today—targeted advertising. Targeted advertising has received increased scrutiny from the European Data Protection Board, the Federal Trade Commission (“FTC”), the White House Office of Science and Technology Policy, and other regulatory bodies. In response to regulatory and market pressures, the dominant technology companies have introduced sweeping changes, including the deprecation of third-party cookies and allowing consumers to choose what ad topics they want to see or not. This article

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contends that these shifts may be necessary, but are insufficient for protecting consumer wellbeing.

In a series of empirical studies, we asked more than 1,000 U.S. adults about their comfort level with twenty-eight ad topics (e.g., eating disorder treatment, gambling websites, sexual enhancement products, bicycles). Results show that participants’ comfort with ad topics exists on a spectrum rather than a binary; ad topics cannot be universally classified as sensitive or not sensitive. A shift from targeted advertising to contextual advertising improves comfort levels on average; however, for a subset of particularly sensitive topics, that improvement is washed out. Ad topic relevance, a prominent metric in machine learning, is sometimes correlated with increases in comfort but is also correlated with decreases. Finally, comfort with targeted advertising in digital out-of-home contexts (e.g., grocery stores, gyms, bathrooms) is consistently low.

This article provides empirical support illustrating the large gap between the law’s privacy protections and people’s expressed preferences. If applied to inferences, the law’s approach to data, sensitive or not, will fail to align with consumer preferences. Those most at risk, who are experiencing health, financial, relational, or behavioral challenges, may be in need of more stringent protections. Deprecating third-party cookies preserves privacy in some ways but it does not prevent topic-based targeting. Instead, it entrenches inferential power into a few companies’ hands—those that control the majority of the data ecosystem. Any reforms to excessive data collection and inference should consider the risks to individuals and groups being targeted, and the legitimacy of the institutions doing the targeting.

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I. INTRODUCTION

The data collected about us can reflect who we are as people—our preferences, our activities, our careers, and our relationships.\(^1\) We are, of course, more than our data profiles, but our data profiles can approximate many facets of our lives. With this approximation trailing us everywhere we go, data inferences are like a funhouse full of mirrors. The mirrors may be distorted or broken, or perhaps pristine, exposing visitors to myriad portrayals of ourselves—sometimes accurate, sometimes not, sometimes encouraging, sometimes not. This might be appropriate for a funhouse but it is not appropriate for data inferences. People should understand not only what data about them is collected, but what inferences are made about them, why those inferences are made, and to what end.\(^2\)

Privacy concerns are not only about allowing users to know and consent to their data being collected. On the other end of the pipeline are sophisticated machine learning models that use data sources to build profiles of users, sometimes referred to as “data doubles” or “shadow profiles.”\(^3\) Privacy scholars Danielle Citron and Daniel Solove argue that the language of harm needs to be advanced to recognize that privacy violations, even without an associated cognizable harm (i.e., harms that are recognized by statute such as physical harm or discrimination), are harms in themselves, because they chill self-expression, autonomy, and self-esteem.\(^4\) Inferences made about people can be unpredictable, counterintuitive, and troubling, and in some cases can violate their rights to privacy, intimacy, autonomy, and dignity.\(^5\) These harms can impact freedom of expression, identity, self-determination, and collective governance.\(^6\)

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5 DANIELLE KEATS CITRON, THE FIGHT FOR PRIVACY: PROTECTING DIGNITY, IDENTITY AND LOVE IN THE DIGITAL AGE (2022); Wachter & Mittelstadt, supra note 2, at 573.
6 Wachter & Mittelstadt, supra note 2, at 512; Salome Viljoen, A Relational Theory of Data Governance, 131 YALE L.J. 573, 596 (2021).
An extensive body of research has examined the types of data collected online and users’ attitudes about that data collection.\(^7\) In general, people express apathy, apprehension, and resignation towards data privacy.\(^8\) Even when they desire to protect their privacy, the costs of doing so are often prohibitive, leading them to behave in ways that are misaligned with their preferences.\(^9\) While most empirical and regulatory conversations have focused on data collection and use, inferences have seen more attention in recent years. Inferences refer to the machine learning predictions about consumer interests, preferences, and behaviors. People express uncertainty and apprehension about why an ad may be targeted towards them, theorizing it was related to something they clicked on, something they bought, something someone else did, or somewhere they went.\(^10\) They also develop folk theories, such as that their devices are listening to them, though most device and app makers claim not to be doing this.\(^11\) People tend to want explanations for why an ad was targeted towards them if they feel the ad is creepy or they don’t know why it was targeted to


\(^{10}\) See Eslami et al., *supra* note 8; Vitak et al., *supra* note 8; Cami Goray & Sarita Schoenebeck, *Youths’ Perceptions of Data Collection in Online Advertising and Social Media*, 6 PROC. ACM HUM.-COMPUT. INTERACT. 475:1 (2022); Blase Ur et al., *Smart, Useful, Scary, Creepy: Perceptions of Online Behavioral Advertising*, in *PROCEEDINGS OF THE EIGHTH SYMPOSIUM ON USABLE PRIVACY AND SECURITY* 1 (2012), https://doi.org/10.1145/2335356.2335362 [https://perma.cc/SPY3-WS8M].

They also tend to treat plausible inferences as logical but rationalize implausible inferences by finding an explanation for it. This article examines people’s attitudes about sensitive inferences in the context of the most sophisticated inference ecosystem on the Internet today – targeted advertising. Targeted advertising, also referred to as personalized advertising or online behavioral advertising, builds sophisticated aggregate profiles based on group- and population-level behaviors to predict what kinds of ads might interest a particular individual. The targeted advertising industry is currently making substantial shifts away from third-party tracking in the face of increasing public and regulatory pressure. It is not clear, however, whether these shifts are in fact privacy preserving or is merely an illusion while the “inference economy” continues to thrive. This article explores this question via empirical user studies by demonstrating how people’s attitudes towards sensitive inferences are important for shaping how we build and regulate inferential technologies. People’s attitudes may not dictate policy directly, but they reveal and illuminate the stark difference between data privacy laws’ stated goals and the actual impact that those laws have on the people who they ostensibly serve to protect. One of the functions of the law is reflecting our expressed norms as a society – and, as this article illustrates, the law on data privacy does not capture people’s preferences.

We conducted a series of online surveys to measure people’s comfort with potentially sensitive ad topics (e.g., cancer treatment, infertility treatment, alcoholic beverages, weight loss products). Our empirical studies examine comfort under different conditions, by varying ad topics, company that is hosting the ad, stated purpose of the ad, and location of the ad. We also compare comfort with the ad topic versus relevance of the ad topic, revealing a brittle relationship between the two metrics.

This article explores why and how a focus on sensitive inferences is warranted given the theoretical underpinnings of data in the modern economy, and how our relationship with our data is a mirror to our sense of

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13 See Rader et al., supra note 7.
16 See Solow-Niederman, supra note 2, at 404.
17 See infra Part III.
self in the modern economy. This article begins with exploring the current regulatory status of targeted advertising, and contemporary responses from industry itself. In Part II, this article analyzes the regulatory status of data rights and privacy, expounding on the power of inferential data. Part III describes our study design and results. Finally, Part IV focuses on reflections and recommendations, exploring how the law might think alternatively about data and inferential sensitivity.

II. THE LEGAL LANDSCAPE OF DATA AND INFERENCE

A. Data rights and data privacy

The Internet enabled the massive growth of personal data but with little ex-ante planning of how to collect, store, aggregate, and use that data. As such, scholars have been trying to make sense of who has a right to what regarding personal data. Personal data has been characterized as relational,\(^\text{18}\) intimate,\(^\text{19}\) collective,\(^\text{20}\) a property right,\(^\text{21}\) a privacy right,\(^\text{22}\) a human right,\(^\text{23}\) intellectual,\(^\text{24}\) and in myriad other ways. The representation of people as data points has enabled a surveillance ecosystem that tracks our digital behaviors and preferences wherever we go.\(^\text{25}\) We are more than the data we produce, but when we go online, we become data points in a digital economy.\(^\text{26}\)


\(^\text{22}\) Citron, supra note 4 at 846; Solove, supra note 2.


While people have some amount of legal control over their body and their property, they have little control or even awareness over their individual data representations. They have even less control over the relational nature of data. Machine learning models capture known or inferred relationships based on revealed attributes and make inferences and predictions. It is no surprise then that people feel “confused and helpless” with regard to data privacy and they are generally unable to express their choices online in ways that align with their privacy preferences. In the absence of effective user controls or corporate accountability for data privacy, the remaining lever is regulatory reform. To date, however, U.S. courts have attempted to tackle privacy harms with “considerable disarray.”

Privacy scholars have been calling for greater protection of users’ data privacy since the rise of “electronic commerce.” In 1998, Lorrie Cranor observed in a sentence that just as well could have been written in 2023, “[m]any people will be watching over the coming months to see how well self-regulatory guidelines, privacy seals and privacy-enhancing tools address Internet privacy concerns.” Indeed, since then, a flurry of privacy laws have been passed to meet the goals established nearly a quarter of a century ago. The FTC has proposed that traditional ideas about personally identifiable data (e.g., names, social security numbers) have become blurred as people become identifiable through their digital profiles. Under the General Data Protection Regulation (“GDPR”) in the European Union (“EU”), businesses are supposed to collect and process data only for a well-defined purpose. By requiring a well-defined purpose, the EU seeks to better protect users’ privacy from being bundled with contracts unless necessary. Similarly, the Organisation for Economic Co-operation and
Development (OECD’s) Collection Limitation Principle first recognized data minimization as a basic right: “[T]he collection of personal data and any such data should be obtained by lawful and fair means and, where appropriate, with the knowledge or consent of the data subject.”

The practice of notice and consent, also referred to as notice and choice, refers to people’s right to understand where and under what conditions their personal information flows and to have control over that flow. Most instantiations of consent online, however, are based on a fallacious model of “informed consent.” Informed consent is usually obtained through what contract law calls “clickwrap contracts,” or contracts where people click to accept terms and conditions. These terms and conditions usually include a privacy policy: a ubiquitous (and long regarded as inadequate) way for companies to address data privacy concerns. Clickwrap agreements are usually treated as enforceable, though users almost never read them. They serve to “manufacture consent” by confusing users and overwhelming them with the burden of having to repeatedly click to express “consent”, a practice known as “dark patterns.” Consent to data sharing is an illusion, rarely administered well.
or meaningfully. A largely hands-off approach to regulation underlies and enables the problems plaguing online consent. The FTC has, until recently, supported self-regulation in the technology sphere. The result is a regime in which corporations “are largely free to exploit data as long as they disclose their intentions in a privacy ‘notice’ and give consumers some ‘choice’ about whether they wish to share their data.” The GDPR allows data collection and processing if it aligns with a company’s “legitimate interest”; however, the term’s flexibility and ambiguity, coupled with a lack of enforcement, results in legal loopholes and mismatches between corporate data collection and user expectations.

The way that data privacy is conceptualized in the law leaves people unsure about how they should think about their data and ownership of it. This ambiguity contrasts with more established areas of law. Take, for example, the case of property law, and how it treats the owner’s relationship with the home. Legally, courts have settled on general, common elements of trespass: (1) intentionally entering or remaining on; (2) another individual’s property; and (3) without authorization or consent. Trespass does not require harm because we as a society know, or at least agree, that the act, in and of itself, causes damage. People experience a form of consequential psychological harm when somebody comes into their house and sleeps on their bed, even if the trespasser leaves everything exactly the way it was before their invasion. In contrast, it is not clear that any consensus exists regarding how to characterize the harm that results from the invasion of data privacy. Is leaking data, without anything else, harm? This question has not been settled because, in the privacy context, the law seeks to rectify only cognizable, and thus previously

43 Viljoen, supra note 6; Richards & Hartzog, supra note 42, at 970.
recognized, harms. For example, the police cannot go into your house and record your front porch without a warrant. However, digital lives are not as readily protected. Police can access data from your Amazon Ring without a warrant, because the privacy harms of doing so have not been recognized in the same way that physical privacy harms have.

The way privacy law is currently organized reduces people to sources of information—objects of data—and explicitly commercial ones at that. However, we should be wary of conceptions of rights and the law that treats citizens as “consumers of data-driven services.” Through this lens, harm is only harm, i.e., legally cognizable, if it is commercial. Commercial harms are of course significant, but a more holistic view on data rights might grant legal protections to personal data that are as strong as those granted by property rights associated with the home. Under this view, intent or outcome would not matter, just as under the property rights approach, someone else cannot enter your home and sleep in your bed.

Many privacy scholars oppose property approaches to data, in part because they offload the responsibility to manage data to individuals. There is another possible way to conceptualize data that might more accurately capture how people feel about it: as a type of bodily autonomy right. The harms associated with violations of bodily autonomy would be greater than those if data were classified as a property right. Bodily autonomy is generally enshrined in the law. For example, patients almost always have a right to decide the type of medical care appropriate for them, though the Supreme Court’s 2022 decision in Dobbs v. Jackson Women’s Health Organization complicates this right. In Dobbs, the Supreme Court held there is no constitutional right to an abortion, underscoring that the “Supreme Court has largely not extended a right to privacy to include a

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46 See Citron & Solove, supra note 4.
50 See Margot E. Kaminski, The Case for Data Privacy Rights (Or, Please, a Little Optimism), NOTRE DAME L. REV. REFLECTION 385 (2022) (giving an overview of criticisms).
right to data privacy.” Still, some types of data have special protections (e.g., health data, human subjects data). Data can be treated differently because of its inherent attributes, not just because of the way it might be used.

B. Inferences, explanations, and sensitivity

Targeted advertising is enabled by the field of machine learning (“ML”), which allows for sophisticated classification, prediction, and inference about people’s future behavior based on data traces. ML outperforms traditional advertising metrics like market segments based on demographics or non-digital contextual advertising (e.g., a Gatorade ad at a gym). ML is used to predict which ads will align with consumer interests, to evaluate ad quality themselves (e.g., using Amazon Rekognition to evaluate ad visual design), and to evaluate efficacy of ad placements (e.g., based on click-through metrics). ML also enables real-time bidding, where near-instantaneous decisions can be made on what advertisement to show to what user at the time of page load. Amazon, for example, evaluates over 100,000 ad requests per second, with a latency on the order of milliseconds, through an expansive set of deep-learning tools to support hardware, hosting, inference, and speed. Advertising technology (“ad tech”) ML relies heavily on the concepts of relevance and interest in its models—the belief is that ads that are relevant or of interest to users will be most profitable for advertisers.

Despite the sophisticated engineering that powers ML model development and evaluation, inferences are subject to errors and biases.

54 See Jin-A Choi & Kiho Lim, Identifying Machine Learning Techniques for Classification of Target Advertising, 6 ICT EXPRESS 175, 175 (2020).
56 See, e.g., Ad Relevance Diagnostics, META, https://www.facebook.com/business/news/relevance-score [https://perma.cc/8U8T-EUL7]. Meta’s ad relevance diagnostics uses behavioral metrics like views and conversions to determine what ads might be relevant to users, which in turn should increase profit for businesses and for Meta.
57 See SAFIYA UMHOJ NOBLE, ALGORITHMS OF OPPRESSION: HOW SEARCH ENGINES REINFORCE RACISM (2018); Joy Buolamwini & Timnit Gebru, Gender Shades: Intersectional Accuracy Disparities in Commercial Gender Classification, 81 PMLR 1 (2018),
Selection bias, measurement bias, and other types of biases or confounds can lead to noisy predictions at best and discriminatory or physically harmful outcomes at worst. While ML (and especially its subfield of artificial intelligence, or “AI”) can be powerful, it does not know how to identify nuanced, contextualized concepts like harm, sensitivity, or privacy. The use of ML can therefore threaten the rights associated with those principles, such as rights to protection from bias and harm, to protection of sensitive data, and to privacy and dignity.

It is not surprising, then, that people distrust both AI and ad tech. Though the nature of people’s understanding and trust of targeted advertising has evolved over time, some overarching themes are consistent: people do not understand what data is collected about them, do not understand how ads might be tailored to them, and find various aspects of targeted profiling creepy or invasive. A 2012 study showed that people also have mixed feelings about ads, showing participants found online behavioral advertising to be useful but also privacy invasive. A decade later, a 2022 study showed that young people found behavioral advertising to be useful but also creepy. One study suggests that people in the United States are more concerned about inferences about their sexual orientation and less concerned about inferences about their health and friendships, with mental health, location, and political views falling somewhere in between. Most people want to understand how digital marketers use information they collect about online activities. Some studies suggest that increasing the visibility of profiling and explaining how it works in interpretable, non-creepy ways may help people understand how ads are triggered.

See generally Solow-Niederman, supra note 2. Solon Barocas & Andrew D. Selbst, Big Data’s Disparate Impact, 104 CALIF. L. REV. 671 (2016); Buolamwini & Gebru, supra note 57; NOBLE, supra note 57.

McDonald & Cranor, supra note 8; Goray & Schoenebeck, supra note 10; Eslami et al., supra note 8; Ur et al., supra note 10.

Goray & Schoenebeck, supra note 10; Ur et al., supra note 10.

Sarah Gilbert et al., Measuring Americans’ Comfort with Research Uses of Their Social Media Data, 7 SOCIAL MEDIA + SOCIETY 1 (2021).

See Joseph Turow et al., Americans Can’t Consent to Companies’ Use of Their Data: They Admit They Don’t Understand It, Say They’re Helpless to Control It, and Believe They’re Harmed When Firms Use Their Data – Making What Companies Do Illegitimate, (Feb. 2023) https://www.asc.upenn.edu/sites/default/files/2023-02/Americans_Can%27t_Consent.pdf.

Natã M. Barbosa et al., Who Am I? A Design Probe Exploring Real-Time Transparency about Online and Offline User Profiling Underlying Targeted Ads, 5 PROC. ACM INTERACT. MOR. WEARABLE UBQUITOUS TECHNOL. 88:1 (2021); Lee et al., supra note 12; Eslami et al., supra note 8.

https://proceedings.mlr.press/v81/buolamwini18a/buolamwini18a.pdf [https://perma.cc/3MHP-FM5H] (both sources demonstrating how algorithms can be biased or discriminatory against Black women specifically).
Auditing ad tech is difficult because of the ephemeral nature of ads and also their exclusionary nature—people cannot know what they don’t see or what others do. Researchers and civil society organizations have argued that “gatekeeper” partners should be audited by neutral parties. Ensuring anonymity with ad tech data is also difficult. Even if people are not identifiable, they can still be subject to consequential and discriminatory inferences and predictions based on their activities and attributes. The consequences of inferences are likely to be most harmful for people who have been historically marginalized, excluded, and oppressed. Danielle Citron calls for a right to “intimate privacy” and against what Karen Levy refers to as “intimate surveillance,” to protect the behaviors that are most private, personal, and intimate, which are also often gendered in nature (e.g., sexual behavior, reproductive decisions).

Though some personal data has certain protections governing its use (e.g., financial data, health data), the concept of sensitive data remains undertheorized, arbitrary, and incoherent. Labeling data as sensitive is, as Paul Ohm stated in 2014, a regulatory “showstopper.” While regulation of data has been largely permissive in the United States, data labeled as sensitive becomes subject to strict oversight. Even if sensitive data were to become conceptually coherent, Daniel Solove argues, it is a dead end.

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68 Sandra Wachter, Affinity Profiling and Discrimination by Association in Online Behavioral Advertising, 35 BERKELEY TECH. L.J. 367, 370 (2020); Citron, supra note 5; Solow-Niederman, supra note 2; Noble, supra note 57.


70 Solove, supra note 36; Paul Ohm, Sensitive Information, 88 S. CALIF. L. REV. 1125, 1129 (2014).

71 Ohm, supra note 70. This article focuses on U.S. contexts, though some issues will relate to non-U.S. privacy rights and laws.
because any data can give rise to a sensitive inference. Indeed, sensitive inferences from users’ online data can be unpredictable, counterintuitive, and troubling, and may violate people’s rights to privacy, intimacy, self-determination, and dignity. The lack of regulation of inferences, whether sensitive or not, leaves “regulation” to be largely shaped by market forces. That is, whether an inference should be made about a person seems to be dictated by whether that inference has any economic value. Companies have introduced some options to give people more control over their sensitive ad experiences. Google has an option to toggle off alcohol and gambling ads and it enforces policies restricting alcohol ads to websites that are predominantly for adults and that are not contextually inappropriate, such as pregnancy websites. Facebook also allows users to select the option “Show less ads about this topic” for a wide range of topics, including alcohol. Setting these preferences does not guarantee that all ads on that topic will be removed, given that ad targeting is automated and subject to error, but it substantially increases the likelihood.

C. Targeted advertising

Advertising in the United States is regulated by the FTC, with additional legal oversight provided by the Food and Drug Administration and additional industry oversight provided by the Better Business Bureau, a non-governmental nonprofit organization. These organizations were formed in the early twentieth-century in response to widespread false and dangerous product advertising. For many decades, advertising relied on market segments based on gender, interests, and activities. A television show for women at home during the day might advertise products related to cleaning supplies or child rearing. Today, advertisements pervade print, radio, television, streaming services, email, social media, and physical infrastructure like benches, buses, and freeways.

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72 Solove, supra note 2.
73 Citron, supra note 5; Wachter & Mittelstadt, supra note 2.
75 Ad Topics, META, https://www.facebook.com/adpreferences/ad_topics. Facebook users can visit this preferences page and specify ad topics they want to see more or less of. Some topics, including alcohol, do not have a “See more” option and only allow users to select “See less”.
77 See JULIANNA SIVULKA, SOAP, SEX, AND CIGARETTES: A CULTURAL HISTORY OF AMERICAN ADVERTISING 218 (2nd ed. 2011).
The Internet enabled a transformative shift from coarse advertising segments to advertising at a personalized level.\textsuperscript{78} Smartphones further enabled that shift, creating new vectors for data collection and ad targeting (e.g., location tracking, linking behavior by device using the “Identifier for Advertisers” on Apple and the Google Advertising Identifier on Android).\textsuperscript{79} This enabled a complicated ecosystem with distributed responsibility for people’s privacy. Data brokers oversee personal information for the vast majority of people in the United States, but their obfuscated position in the targeted advertising ecosystem leaves them with little public or regulatory visibility.\textsuperscript{80} App developers generally consider ad networks, rather than developers themselves, responsible for potential risk to people associated with ad setting configurations.\textsuperscript{81}

Platforms such as Google or Facebook have used cookies to track users as they browse the internet, gathering data from websites visited, items put into a shopping cart, search terms, or what someone has “liked.”\textsuperscript{82} First-party cookies are created by the website that is currently being visited, allowing that website to track user behavior on the site. Third-party cookies are created by any third-party server that “travels” with the website the user visits.\textsuperscript{83} For example, if a user is on Facebook, the cookies established by the Facebook website are first-party cookies, and any company that Facebook allows to advertise on its site can embed third-party cookies. Third-party data providers can also track user behavior to deduce demographic markers (e.g., age, location, gender, religion, political preferences, income), then sort them into “audience lists” that are then

\begin{itemize}
\item \textsuperscript{78} See Alvin, What is Mobile Advertising and How Does It Work?, MOBILEADS (Nov. 2, 2020), https://www.mobileads.com/blog/mobile-advertising [https://perma.cc/34GM-W9WE].
\item \textsuperscript{79} advertisingIdentifier, \textsuperscript{APPLE}, https://developer.apple.com/documentation/adsupport/arsidentifiermanager/1614151-advertisingidentifier [https://perma.cc/SET4-3TPT]; Advertising ID, \textsuperscript{GOOGLE}, https://support.google.com/googleplay/android-developer/answer/6048248 [https://perma.cc/ULE6-TZ26].
\item \textsuperscript{80} See Data Brokers, \textsuperscript{EPIC}, https://epic.org/issues/consumer-privacy/data-brokers/ [https://perma.cc/KVG7-6KFK].
\item \textsuperscript{83} See Wachter & Mittelstadt, supra note 2.
\end{itemize}
handed to advertisers. In 2018, the GDPR began requiring that websites allow users to opt out of third-party cookies. Though it protected European user rights specifically, many websites have complied with GDPR transnationally, and some U.S. states are moving towards GDPR-inspired laws. However, opting out has been so burdensome that most users accept tracking rather than having to opt-out of each site they visited. In late 2022, the EU argued that Facebook cannot continue targeting ads based on user’s online activity without affirmative, opt-in consent. That is, instead of requiring users to opt-out of tracking on each website, users must affirmatively opt-in. In early 2023, the EU fined Meta, Facebook’s parent company, for effectively forcing users to accept personalized ads. In this case, the EU argued, bundling consent to ad personalization within the terms of services violated Article 7(4) of the GDPR.

Facing this increasing public and regulatory pressure, many of the dominant tech companies have made or plan to make substantial shifts in their advertising practices. In early 2020, Facebook rolled out a tool that allows users to “clear” and/or “disconnect” the websites they visited from being tracked, a move that the Electronic Frontier Foundation deemed “welcome but incomplete.” Facebook has also partnered with Mozilla to develop Interoperable Private Attribution, a system that prevents websites or advertisers from linking data to individual users. In 2021, Apple enabled App Tracking Transparency (“ATT”) which requires that apps ask

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89 Satariano, supra note 33.


91 Erik Taubenek et al., Interoperable Private Attribution (IPA) (Jan. 5, 2020), https://docs.google.com/document/u/1/d/1KpdSKD8-Ro0bWPTu4UtK54ks0yv2j22pA5srAD9av4s/ [https://perma.cc/455X-LMF3].
for permission to track users outside of their own app. They can still track users within their app by default. For example, DoorDash can track users’ behavior within its app, but it cannot track them across other apps without express permission. A main impact of this shift is that advertisers have to move from user-specific advertising to group advertising (i.e., by determining the audience who should be exposed to an ad). Meta predicted that Apple’s move would decrease Meta’s 2022 sales by around $10 billion. The ad industry indicates that Meta, Snap, and other smaller hosts have indeed seen a drop in revenue, which is likely due in part to Apple’s move, as well as general economic slowdowns.

The biggest shift on the horizon is the deprecation of third-party cookies from the Internet ecosystem. As regulators increase pressure in the EU and the United States, Google has stated it will phase out third-party cookies from its Chrome browser by 2024. Though Safari and Firefox did this a few years earlier, Chrome has sixty to seventy percent of the market share. A post-cookie world means a shift from third-party advertising—the mainstay of the Internet advertising ecosystem for over a decade—back to contextual advertising, where first-party platforms retain control over people’s interactions with advertisements. To plan for a cookie-less Internet experience, Google is rolling out a Privacy Sandbox with various advertising solutions for advertising partners to transition to. The Topics API allows the browser to share a few user topics with the ad tech platform (e.g., Hiking) based on their browsing behaviors. Google’s team has argued that the Topics API facilitates a substantial increase in privacy and that removal of all targeting would destroy the web because people do not

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want to pay for their online browsing experiences.98 The Interactive Advertising Bureau (“IAB”), which represents hundreds of marketing and technology companies, agrees: “data-driven advertising substantially benefits both consumers and competition, such as by (1) supporting the United States economy and creating and maintaining jobs; (2) enabling consumers to access free and low-cost products and services; and (3) supporting small businesses and reducing barriers to entry for businesses.”99 Google has also expressed a commitment to increasing transparency, fueled in part by decreased consumer trust in data practices and by regulatory concerns about political ads.100

The new form of advertising will rely on first-party IDs or universal IDs, where users are assigned an identifier that is consistent within a publisher, or consistent across the web, respectively. It will also rely more heavily on group or affinity profiling where assumptions are made about people’s interests based on the shared interests of others like them. These changes protect users from the privacy threats associated with third-party tracking, but maintain multiple risks, albeit ill-defined ones. One well-documented risk is “discrimination by association,” or discrimination experienced by association with a group.101 Another is that revoking third-party access redirects data control to the companies that have first-party oversight over the largest shares of our online data like Google, Meta, Amazon, and Apple. More generally, we don’t know how these shifts will reconfigure the advertising industry and whether they will meaningfully increase consumer rights and wellbeing.


III. EMPIRICAL STUDY

We conducted an empirical study to examine people’s attitudes about current and future landscapes of sensitive inferences in targeting advertising. Empirical studies enable us to examine alignments and misalignments between the law, corporate practices, and consumer well-being. This section describes the study design, data collection, and results. Part IV introduces regulatory considerations and concerns based on the empirical results.

A. Study design

We conducted three online surveys to measure people’s attitudes and preferences around sensitive inferences. Survey 1 tested relevance of and comfort with ad topics, differences in reactions based on the company hosting the targeted ads, and differences based on how the purpose of the ad is presented. Survey 2 measured differences in comfort between behavioral and contextual ads, as well as general levels of comfort and sensitivity with the ad topics. Survey 3 measured differences in comfort by the physical location of the ad. This research was exempted from full review by our Institutional Review Board. All participants were shown a consent form before proceeding to the survey. The study was designed to compensate participants a minimum of $15 per hour and typically higher to include transition times to take and complete the study. Actual completion time medians and compensation rates were 4 minutes, 58 seconds, $3 (Survey 1); 4 minutes, 18 seconds, $2 (Survey 2); 4 minutes, 41 seconds, $2 (Survey 3).

Survey 1. Survey 1 used a factorial design experiment that allowed us to measure the effects of each variable on the outcomes of interest. The factorial design used multiple variables, known as factors, which each had multiple levels. We calculated sample size by considering the number of levels in each factor and the between versus within subject design to evaluate each experiment combination. We chose to have at least twenty responses per combination to have enough diversity in each set of responses.102

This survey had two Outcome levels, three Purpose levels, four Company levels, and twenty-eight Advertisement type levels (see Table 1). The survey was displayed using a matrix design where the two Outcome levels (Relevance and Comfort) had a matrix with ten ad topics each. With

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102 Recommendations for minimum sample sizes per bin vary from 5 to 30 or more. See, e.g., Willem A. Arrindell & Jan van der Ende, An Empirical Test of the Utility of the Observations-To-Variables Ratio in Factor and Components Analysis, 9 APPLIED PSYCH. MEASUREMENT 165 (1985).
participants completing a total of twenty responses each and a target of twenty responses per combination, the minimum sample size was 672 participants. The Measure factor measured Relevance, a prominent metric in ad machine learning models, and Comfort, our approach to measuring people’s attitudes using a concept they could easily understand and respond to.

Relevance was measured on a five-point scale with one being “Not at all relevant” and five being “Extremely relevant.” Comfort was measured with one being “Extremely uncomfortable” and five being “Extremely comfortable.” The Purpose factor measured targeting language explanations used by Google and Facebook as well as a generic alternative we created.\(^{103}\)

We selected the Advertising topics via iterative discussions, literature reviews, surveys of the field, and pilot testing. We added and removed topics (e.g., added Weed or marijuana after discussion; removed Home loan after pilot testing). We aimed for a diversity of topic types that would manifest ranges of comfort, relevance, and sensitivity. We intentionally included some topics that we know to be recognized as legally sensitive (e.g., Religious services), personally sensitive (e.g., Infertility treatment), and those that are seeing changing regulatory and market environments (e.g., Gambling websites, Alcoholic beverages). Conversely, we included some that we expected to be rated relatively favorably (Your favorite foods, Your favorite types of shoes). We also included four “control” topics that we expected participants to be generally neutral or very slightly favorable towards as a reference point (Headphones, Bicycles, Paper towels, and Can openers).

Prompt
[Company] tracks your online behaviors, such as other websites you have visited, Internet searches you have made, your purchase history, and your cell phone location. [Company] then use that to target ads to you [purpose].

Measure
For each ad topic below, how relevant is that type of ad to you?
For each ad topic below, how comfortable are you with that type of ad being targeted to you?

Purpose
to keep the websites and services you use free of charge [Google]
to be personalized to your interests and to introduce you to new things [Facebook]
to make money

Company
Websites; Google; Instagram; Amazon

Ad Type
Cancer treatment; Burial or cremation services; Hair loss treatment; [physical health]
Depression treatment; Anxiety treatment; Eating disorder treatment; Therapy or counseling [mental health]
Infertility treatment; Baby products; Birth control; [reproductive health]
Alcoholic beverages; Tobacco or e-cigarettes; Gambling websites; Weed or marijuana [substance use]
Bankruptcy lawyer; Loan services; [financial]
Divorce lawyer; Dating websites; [relationships]
Political candidates; [politics]
Religious services; [religion]
Sexual enhancement products; Weight loss products; [self]
Your favorite foods; Your favorite types of shoes; [favorites]
Headphones; Paper towels; Bicycles; Can openers; [control]

Table 1. Survey 1 prompt and variables.

The factorial design used the Prompt text and randomized filling in the other variables. The survey was programmed to be grammatically
accurate (e.g., if “Google” was chosen then it was paired with “tracks,” whereas “Websites” was paired with “track”). The Measure factor used a
within subjects design where participants completed both levels. To
minimize complexity and increase readability and interpretability, the
Purpose and Company factors used a between subjects design where each
participant saw only one level for all of their twenty responses. In the
example above, the Company factor would be held constant in the between
subjects design such that the participant only saw “Websites” for each of
their twenty prompts and never saw “Google” or “Instagram.” Between
subjects can reduce cognitive demands by minimizing the number of
variables participants have to compare when doing a repeated measures
design (in this case, where they are completing twenty prompts). The Ad
Type factor used a mixed design where participants saw a randomly
selected subset of ten of the twenty-eight options. Both study design types
(between, mixed) used randomized counterbalancing such that across the
experiment there were roughly equal numbers of responses for each level.
Participants who rated one or more ad topics as somewhat or extremely
uncomfortable were asked a free response question for each topic about
why that ad topic was uncomfortable for them.

After the factorial section, the survey included the same set of
questions for all participants. This included commonly measured
demographic information like age, gender, and race. It also included
questions corresponding to the ad type variables to include those in
regression models. For example, asking how often the participant uses
tobacco or e-cigarettes allowed us to measure if use correlates to comfort
with targeted ads about tobacco or e-cigarettes. We included questions
related to sensitive ad types but did not include any for the favorites or
control ad types described in Table 1.
Behavioral advertising
Websites track your online behaviors, such as other websites you have visited, Internet searches you have made, your purchase history, and your cell phone location. Websites then use that to target ads to you. How comfortable are you with websites targeting the following ad topics to you?

Contextual advertising
Websites display advertisements to you based on the content on the website. How comfortable are you with websites displaying the following ad topics to you?

General comfort
In general, how comfortable are you with the following topics?

General sensitivity
In general, how sensitive are the following topics?

Table 2. Survey 2 prompt and variables.

Survey 2. This survey tested for differences in comfort between targeted advertising, contextual advertising, and no advertising (i.e., asking about comfort with the topic generally). This survey had those three prompt variations and the same 28 advertising topics as above (see Table 2). It then asked a subset of the demographic questions used in Survey 1. As with Survey 1, participants who rated one or more ad topics as somewhat or extremely uncomfortable were asked a free response question for each topic about why it was uncomfortable. We again chose a minimum of twenty responses for each of the five prompts with participants completing eighteen prompts for a total minimum of 156 participants.

Survey 3. This survey evaluated comfort shifts based on location of the advertisement. This was designed to understand people’s attitudes for “Out of Home” contexts, a domain of growing interest in the digital advertising industry. This survey randomly displayed one of sixteen possible locations where advertisements might be displayed (see Table 3). The survey focused on contexts where ads might be observed currently.

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104 This study had an additional manipulation check for whether anchor choices influenced responses for comfort (specifically, whether responses changed if the scaled was “Extremely uncomfortable” – “Extremely comfortable” versus “Not at all comfortable” – “Extremely comfortable”). The answer is yes; the “Not at all” scale shifted responses about 0.1 points lower in comfort compared to the “Extremely uncomfortable” scale.

based on a review of ad tech industry trends, and with varied modality (e.g., voice) and context (e.g., gym). Again, participants who rated one or more ad topics as somewhat or extremely uncomfortable were asked a free response question for each topic about why it was uncomfortable. The survey had a minimum of twenty responses for each of the sixteen prompts with participants for a total minimum of 320 participants.

Data analysis. We used descriptive and inferential statistics to analyze quantitative results and qualitative coding to analyze the free responses.\textsuperscript{106} We used ANOVA to compare group means (Section C1, C2, and C3), correlation tests to compare variables (C1), and linear regressions to predict outcomes (C4). We did not include all demographic and behavioral variables we collected in the regression models to decrease the likelihood of spurious correlations.\textsuperscript{107} Our approach to regression model building was to start with controls, specifically including age, gender, and race, then to add the subset of variables that are theoretically relevant to the ad topic. We selected models using adjusted R-squared. All tests were run in the software, R. Means and standard deviations are reported using the symbols $\mu$ and $\sigma$.

\textsuperscript{106} We recognize the irony of using inferential statistics to interrogate the concept of inferences.

\textsuperscript{107} The problem of false positives (variables appearing to be significant when they are not) is sometimes addressed with multiple testing corrections, such as the Benjamini-Hochberg test, but we chose to constrain the tests we ran and reports we result to minimize spurious findings. Some variables had relatively high correlations to each other, such as religion and political views, and being married and having children (0.4-0.5 ranges). In those cases, we ran models with either or both variables and used adjusted R-squared values to select a better fit model.
During our exploratory analysis, we observed that people who used weed or marijuana regularly (5 or more times a week) were substantially more comfortable with ad topics overall ($\mu=3.26; \text{SD}=1.01$) compared to those who used it rarely or never ($\mu=2.90; \text{SD}=0.90$). We declined to add weed or marijuana use as a predictor in our models because it substantially skewed the adjusted $R^2$ value higher for almost every model.\textsuperscript{108}

For the qualitative analysis, each of the three surveys asked participants why they were uncomfortable with the targeted ad topics that they had rated somewhat or extremely uncomfortable. They were asked to explain each ad topic in a separate check box. In Studies 2 and 3, participants who did not rate any ad topics as uncomfortable were asked one general question about why they found most ad topics comfortable. There were over 8,500 responses across the 1,500 participants. As is typical with surveys, some of the responses were low quality and not informative.

\textsuperscript{108} We cannot tell whether people who use weed or marijuana’s comfort with targeted ads of sensitive topics is a trait or a state; that is, are they always more comfortable or were they in a state where they were more comfortable while taking the survey.
(e.g., “I don’t like it”); our analysis focused on those with substantive responses. We read through responses to identify reasons why participants were uncomfortable.

B. Participant Demographics

We recruited participants on the online platform Prolific. Participants had to be 18 or older, located in the United States, and speak English. We recruited participants for diversity in age, gender, sexuality, ethnicity, religion, health, and disability using Prolific’s screening tools. For Survey 1, we also recruited participants whose self-described behaviors might influence their experiences or attitudes with respect to the ad topics we studied (e.g., tobacco or e-cigarette use). We oversampled based on who may be especially sensitive to targeted ads, either because of their marginalized identity or because of their association to the topics we measured. Oversampling for racial and gender diversity resulted in a sample that leaned more left than right politically. Participant demographics are summarized in Table 4.

<table>
<thead>
<tr>
<th>Survey</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
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<td></td>
<td></td>
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<tr>
<td>Women</td>
<td>478</td>
<td>72</td>
<td>149</td>
</tr>
<tr>
<td>Men</td>
<td>467</td>
<td>75</td>
<td>147</td>
</tr>
<tr>
<td>Non-Binary</td>
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<td>19</td>
<td>39</td>
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<tr>
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<td>32</td>
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<tr>
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<td></td>
<td></td>
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<td>727</td>
<td>89</td>
<td>230</td>
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<tr>
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<td>129</td>
<td>23</td>
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<td>35</td>
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<tr>
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<td>16</td>
</tr>
<tr>
<td>Middle Eastern</td>
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<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Age (average)</td>
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<tr>
<td>Children</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>3+</td>
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<td></td>
</tr>
</tbody>
</table>
### Table 4. Participant demographics for Surveys 1 (N=1,003), 2 (N=173), and 3 (N=341).

<table>
<thead>
<tr>
<th></th>
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<th>2</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td><strong>Health</strong></td>
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<tr>
<td>Poor or Fair</td>
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<td>63</td>
<td>136</td>
</tr>
<tr>
<td>Good or Very good</td>
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<td>110</td>
<td>205</td>
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<td><strong>Sexual orientation</strong></td>
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<td></td>
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<td>LGBTQ</td>
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<td><strong>Relationship</strong></td>
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<tr>
<td>In a relationship</td>
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<td>75</td>
</tr>
<tr>
<td>Divorced</td>
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<tr>
<td>Single</td>
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<tr>
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<td>23</td>
<td>49</td>
</tr>
<tr>
<td>Some college</td>
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<td>Bachelors</td>
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<tr>
<td>Graduate school</td>
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<tr>
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<td>104</td>
<td>200</td>
</tr>
<tr>
<td>Neither left nor right</td>
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<td>31</td>
<td>57</td>
</tr>
<tr>
<td>More right</td>
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<td>38</td>
<td>84</td>
</tr>
<tr>
<td><strong>Religion</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Very or somewhat important</td>
<td>441</td>
<td>83</td>
<td>136</td>
</tr>
<tr>
<td>Little or not at all important</td>
<td>564</td>
<td>90</td>
<td>205</td>
</tr>
</tbody>
</table>

C. Study Results

Results are organized into five sections: what ad topics people are more or less comfortable with; comfort levels with digital out of home
targeted ads; differences in comfort between targeted and behavioral advertising; comfort based on the company hosting the ads and stated purpose of the ad; and why people are uncomfortable with ads.

1. Comfort with targeted ad topics

Figure 1 shows average comfort ratings for targeted advertising, contextual advertising, and the ad topic generally (described in Table 2). The ad topics on the x-axis are sorted in descending order by targeted ads (see Appendix for plots sorted by contextual ads). As expected, the two positively framed topics (Your favorite foods and Your favorite types of shoes) and four neutral topics (Paper towels, Headphones, Can openers, Bicycles) are generally more comfortable topics for both contextual and targeted advertising. Alcoholic beverages and Baby products are also rated highly in comfort, perhaps surprisingly given that both have been prominent topics of conversation in algorithmic targeting. After that is a cluster of topics relating to mental health (Anxiety, Depression, ADHD, Therapy), politics, and the body (Weight loss and Hair loss). The lowest four comfort ratings for targeting are for Sexual enhancement products, Eating disorder treatments, Infertility treatment, and Divorce lawyers.

109 See Davies, supra note 74; Nudson, supra note 84.
Figure 1. Comfort with targeted advertising (green circle), comfort with contextual advertising (blue diamond), and general comfort with the topic (purple square).

The plot shows that comfort with targeted advertising is consistently lower than comfort with contextual advertising, while comfort with the topic is slightly higher in most cases, especially for sensitive topics. The higher distances between targeted and contextual points indicates topics where participants are comfortable seeing ads for the topic but not if the ad is targeted (e.g., Eating disorder treatment, Depression treatment).

Similarly, the higher distances between contextual and general indicates topics where participants are generally comfortable with the topic but not in an advertising context. These are mostly health related, indicating discomfort with targeting of health topics, even if those topics are comfortable when contextually appropriate and in general (e.g., Anxiety treatment, Depression treatment, Birth control). Differences between targeted, contextual, and general means were confirmed with a one-way ANOVA, $F(2)=119.3$, $p<0.001$. Tukey post-hoc tests show that the three categories are significantly different from one another (see Appendix).
Comfort and Relevance are slightly correlated, with correlation varying by topic type. The average correlation between them is 0.32 (where possible values can range from 0, i.e., no relationship, to 1, i.e., perfect relationship). In Figure 2, points that are close together are more strongly correlated and those that are more distanced are more weakly correlated. For example, Infertility treatment has a substantial gap between Comfort and Relevance. Section III.C.5. discusses why we see these gaps for some topics.

Most of the topics were significantly different from each other in Comfort ratings and Relevance ratings. A one-way ANOVA showed that ad topic has an effect on Comfort ratings $F(27) = 79.76$, $p < 0.001$ as it also does for Relevance $F(27) = 109.2$, $p < 0.001$. Tukey post-hoc tests are included in the Appendix; in general, as with Figure 1, most ad topics are significantly different from each other in average ratings but those that are clustered nearest each other on the plot are not.
Figure 2. Comfort with targeted advertising (green circles) and relevance of targeted advertising (purple diamonds).

2. Comfort with out of home targeted ads

Participants expressed overall discomfort with any kind of digital out-of-home advertising. They were relatively more comfortable in nondescript semi-public locations, including an elevator, a train station, and a gas station (see Figure 3). The least comfortable locations were in the car,
which free responses confirmed was about distraction concerns. There was a wide range of location types, such as a mobile phone and an exercise machine at the gym, with generally low comfort and little variance between them (about 0.5 points on the 5-point comfort scale). An ANOVA test confirmed that location has an effect on comfort, $F(15) = 28.59, p < 0.001$. Results from the Tukey post-hoc test are included in the Appendix. In general, they reveal that location types that are clustered near each other on the plot are not significantly different from each other but they are from any types that are further away on the plot.

![Image](image.png)

**Figure 3.** Average comfort with digital advertising in out-of-home locations.

3. Comfort with targeted ads based on company and purpose

There was no difference in Comfort or Relevance ratings among the four company types measured: Instagram, Google, Amazon, and Websites. There was also no difference in purpose: to make money, to keep the websites and services you use free of charge, to be personalized to your
interests, and to introduce you to new things. This suggests that people’s attitudes towards targeted ads are relatively stable—that is, they don’t see substantial differences based on which company (among the three we asked about) is hosting the advertising or for what stated purpose. The comfort plots are shown visually in Figures 4a, b. The one-way ANOVA showed that neither purpose nor company has an effect on comfort or relevance ratings (tests are in the Appendix).
Figures 4a,b. Plots show no significant difference in comfort levels based on which company is doing the targeted advertising or what the stated purpose of the advertising is.
4. *Relationship between behaviors and comfort*

Regression analyses revealed relationships between participants’ comfort with targeted ads and their self-reported behaviors. Here are the cases where participants’ self-reported behaviors positively related to their comfort levels:

- People who gamble are more comfortable with ads for gambling websites
- People who use tobacco or e-cigarettes are more comfortable with ads for those products
- People who use weed or marijuana are more comfortable with ads for those products
- People who are more religious are more comfortable with ads for religious services
- People with anxiety are more comfortable with ads for anxiety treatment
- People with depression are more comfortable with ads for depression treatment
- People who consume alcohol more frequently are more comfortable with ads for alcoholic beverages

There were also relationships for health topics where demographics or experiences related to comfort with health ads, both physical and mental. Here we see the following patterns:

- People who are older or have a health condition are more comfortable with ads for burial or cremation services
- People with cancer are more comfortable with ads for cancer treatment
- People experiencing grief are more comfortable with ads for anxiety treatment and depression treatment
- People who consume alcohol more frequently are more comfortable with ads for depression treatment
- However, people whose sexual orientation is not straight are less comfortable with targeted ads for depression

Finally, a third major pattern related to cultural and societal experiences and values:

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110 This section does not report all significant relationships in the analysis. It focuses on prominent themes across categories.
• People who have had negative recent experiences with dating are less comfortable with ads for alcoholic beverages

• People who are more politically right-wing are less comfortable with birth control ads

• People who are single are less comfortable with birth control ads, baby product ads, and burial or cremation service ads

• People whose sexual orientation is not straight are less comfortable with baby product ads

• People who are married and people who are transgender rate dating websites as less comfortable

A key takeaway is that there can be group level differences in people’s comfort with targeted ads. These differences introduce the risk of systematic biases in how sensitive ads are experienced. Additionally, the patterns we observed reflect many of life’s hardest challenges, and people in the throngs of those challenges should have heightened agency and protections.

5. Why people are uncomfortable with sensitive ad topic inferences

The section above focused on what behaviors and characteristics relate to comfort with targeted ads. This section explores why people are uncomfortable with them. There were four predominant themes:

• This seems to know something about me that I don’t. Some participants feared that inferences could be predictive of a future outcome for them (“What if I’m being targeted for cancer treatment because my search history resembles that of someone with cancer? This scares me.”; “I’d worry that google somehow picked up infertility before I know.”).

• This is relevant to me and I don’t want to see it. Participants were uncomfortable with ad topics that reminded them of struggles they had or have (“It reminds me of my medical issues and child loss”).

• This is irrelevant to me and I don’t need to see it. This was a widespread response across ad topics—if something is not relevant, it may not be comfortable as a targeted ad.

• This should not be targeted to anyone. This was often because it was predatory, biased, or discriminatory in nature. (“I don’t want kids and I often feel, as a woman, that when I’m targeted

111 There is no interaction effect with gender, meaning that women are not more or less likely to associate negative dating experiences with alcohol ad discomfort.
with baby or pregnancy ads, it’s a stereotypical assumption. Just because I’m a woman doesn’t mean I care about babies and pregnancy”).

We elaborate on these themes by connecting them to the four ad topics that were rated low in comfort from Figure 1: Divorce lawyer, Sexual enhancement products, Eating disorder treatment, and Burial or cremation services.

The free responses for Divorce lawyers ranged widely. One cluster of responses described it as being not relevant because they were not married and because it was creepy (“not married and find it creepy”). Some others were uncomfortable because they were married (e.g., “I’m married and don’t like the implications”). For some, it had an explicitly negative memory (“I don’t need to see something that made me very sad once upon a time”). A few were also seeking explanations and forming theories about why they may see the ad, even speculating that they saw the ad because it was relevant to others, such as a partner seeking divorce information (“Because I’m not planning on a divorce, it makes me think that my husband might have been googling for a divorce lawyer on my device.”). Discomfort was usually negative but sometimes arrived with humor in participants’ responses, such as a single person being asked about divorce lawyer ads (“Unsure if I can divorce my hand?? . . . “).

The free responses for Sexual enhancement products focused on a few key themes. Some simply said it was gross, others had privacy concerns such as worries that their children or coworkers might see the ads (“I look at my phone at work lol.”), while others felt it bore stigma (“Sex is a private sphere, you’re invading it AND suggesting I’m inadequate?!”). Some said they would look for the products themselves if they needed to (“If I want to see sexual enhancement products I would search for them myself.”). A few worried about potential subsequent inferences (“This could lead to other types of weird sexual ads.”)

For Eating disorder treatment, many participants said it was not relevant to them but it was inappropriate to be an ad. Some said this topic should be between a patient and doctor. Some talked about the inappropriateness of profiting from it (“I am concerned about predatory services taking advantage of people desperate for help.”; “I don’t have an ED but the fact that it is a profitable niche is disgusting.”). Some participants reflected on their own experiences, both past and current (“I had an eating disorder years ago, and would not like to be exposed to this.”; “I don’t like being reminded of having an eating disorder.”; “I’m sensitive about my poor eating habits, so facing into this would feel a bit
uncomfortable.”). In these cases, participants acknowledged relevance to their personal experience, but seeing the ads was not comfortable for them. A few raised concerns about exposure to ads leading to body image issues (“The body image issues this could create seem really bad.”).

For Burial or cremation services, most participants said that they do not want to think about death. Some talked about their age (“I am young.”) implying lack of relevance, while others talked about the expenses (“I do not enjoy being reminded of death and the high cost of death expenses.”). For many, it brought up painful memories signaling both relevance to personal experience and discomfort with seeing the ads (“My grandfather died a few months ago.”; “I already had a family member die and it is painful to think of.”). One mentioned that they had already planned for their own services, signaling another way participants made sense of burial and cremation service ads’ relevance (“Having lost my own beloved dad when I was young, I arranged for my own cremation and burial ages ago, when I first became pregnant with my daughter, so she wouldn’t need to deal with what I dealt with.”)

IV. REFLECTIONS

A. Sensitive inferences exist on a spectrum

Existing approaches to managing sensitive data are insufficient for determining appropriate levels of protection. We must understand what inferences are sensitive and why.112 Armed with some insights from our empirical studies, we should now consider gaps in privacy law for protecting those sensitive inferences.

The law has approached data as something that is either sensitive or not sensitive, a coarse approach that overlooks nuances in how data is collected, for what purposes, and by whom.113 If inference sensitivity is approached similarly to sensitive data, it too will generate an incomplete portrayal of people’s lived experiences. Many high profile cases reveal the risks associated with inferences for sexual orientation, abortion, mental health, and disease but the concept of inferences has not received the same legal scrutiny as data.114 Our results add credence and generalizability to

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112 See Solove, supra note 2.
113 Ohm, supra note 70; Solove, supra note 2.
114 See Sam Machkovech, Report: Facebook Helped Advertisers Target Teens Who Feel “Worthless” [Updated], ARS TECHNICA (2017), https://arstechnica.com/information-technology/2017/05/facebook-helped-advertisers-target-teens-who-feel-worthless/ [https://perma.cc/PN26-HDR3]; Nudson, supra note 84; Wachter & Mittelstadt, supra note 2; Solow-Niederman, supra note 2; Damian Clifford et al., Artificial Intelligence and Sensitive Inferences: New
stories in the popular press. One journalist lamented the barrage of ads relating to menstruation products after she got off hormonal birth control to conceive a child, particularly as the ads continued through her subsequent fertility struggle.\textsuperscript{115} Women that platforms have identified as 25-35 report being inundated with ads related to “fertility, periods, or babies,” only to later receive ads about menopause if they’re labeled older than 35.\textsuperscript{116} Author Gillian Brockell wrote about receiving pregnancy and baby ads after suffering a stillbirth—platform algorithms had deduced she was pregnant, but the label continued even after she no longer was.\textsuperscript{117}

There are many more examples that elude the neat “sensitive topics” which Google allows users to turn off. A young person exploring their sexuality may be outed against their will when their parents open a shared family computer to see ads for LGBTQ+ content. An undocumented immigrant seeking legal help may feel anxiety or may avoid using the Internet altogether for fear of being tracked and shown ads for immigration attorneys. Someone may learn their spouse is planning for separation after seeing divorce attorney ads on a shared device. If targeting moves off of personal devices and into our built environments, we may see topics that algorithms deem relevant to us on cars, billboards, or gas station screens. Inferences will be experienced in public or semi-public ways, dramatically increasing the sensitive nature of what is being targeted and, as our results suggest, shifting the calculus of what it means to be private.

Google’s approach to cookie-less advertising has sought to address the question of sensitive categories. Their introduction of the Topics API\textsuperscript{118} stated that the initial taxonomy had been human-curated to exclude categories generally considered sensitive, such as ethnicity or sexual orientation.\textsuperscript{119} They also indicated that it would be “public and human-
curated to avoid sensitive categories, and that the goal is for the taxonomy to be maintained by a third party who incorporates feedback from industry stakeholders. However, as we have demonstrated, if people’s comfort with inferences ranges on a spectrum rather than as a binary, an inclusion/exclusion approach may be misaligned with people’s preferences and such misalignments can also be discriminatory. As a commenter in the World Wide Web Consortium ("W3C") noted, “there is no binary assessment that can be made over whether a topic is ‘sensitive’ or not. This can vary depending on context, the circumstances of the person it relates to, as well as change over time for the same person.” Increased data privacy protections, using current approaches to data privacy, will not necessarily yield greater inference protections.

The law has a cyclical nature with people’s preferences: it both reflects and defines them. While people’s preferences shift over time, sometimes rapidly due to changing events (e.g., a pandemic), some preferences become enduring and stable. These preferences and values are central to American political institutions and to policy formation. Our research exposes two ways in which the law should better vindicate people’s rights at the intersection between data privacy and targeted advertising. The law should recognize (1) the sensitivity associated with inferences made from data, and (2) how that sensitivity varies by individuals and groups. Even a brief review of how people reacted to these topics in our research is sufficient to demonstrate the weight of this topic. When ads make people feel inadequate or violated, or to believe the algorithm knows something about them that they don’t, the impact is what Woodrow Hartzog, Evan Selinger, and Johanna Gunawan have labeled


126 See Hovenkamp, supra note 124.
“privacy nicks,” which are small, frequent violations that normalize and bias how citizens and lawmakers view privacy.127 Our research suggests that the law fails to adequately reflect these preferences at the complex intersection of data, inferences, and targeting.

B. Inferences rely on technical infrastructure

The shift from targeted ads to contextual ads has been met with some enthusiasm,128 largely because it involves the removal of targeted ads rather than because contextual ads have been vetted as a desirable alternative.129 But the contextual ad ecosystem that is in front of us is not the contextual ad ecosystem of ten to twenty years ago. There is little indication that we will shift back to purely contextual ads where ads were delivered by coarse user segments rather than by tracking user behavior. Google’s proposed new system matches webpage content with advertisers’ keywords or topics, language, or a users’ recent browsing history or location, among other possible factors.130 Representatives from the W3C, WebKit, and Mozilla have raised concerns about Google’s Topics API.131 One statement says, “We are particularly concerned by the opportunities for websites to use additional data gathered over time by the Topics API in conjunction with other data gathered about a site visitor, either via other APIs, via out of band means, and/or via existing tracking technologies in place at the same time, such as fingerprinting.”132 If the removal of cookies does not necessarily imply the removal of targeting, then the goal posts may have moved, but targeting via inferences persist.

What makes people’s data valuable is that it is about them and can be used to predict their individual behavior. Economic value is intrinsically tied to personhood. Pregnant women and college students have long been valued because they represent important life transitions and an opportunity

128 See Gebhart, supra note 88.
132 Karlin, supra note 123.
to facilitate long-term brand loyalty. Market-oriented solutions have grown around this very idea: we create the economic value of our data, and it seems unfair to allow data buyers to capture it. As a response to this issue, there has been a recent proliferation in “data unions.” Data unions, also sometimes discussed as data markets, offer a glimpse of what it might look like to put people in charge of their data. Data unions could remove the transaction costs associated with frequent, personal management of data. Another alternative is the “data clean room,” aggregated anonymized datasets in a pooled resource that enables holistic views of ad campaign performance. Data clean rooms afford less accuracy than ID-based personalization, but they enhance privacy over traditional custom data platforms which collect and analyze data containing individual user behavior.

However, with both data unions and data clean rooms, it is easy to imagine an oligopolistic market structure where a few providers dominate the market. Already, a prominent type of data clean room is used by Google, Amazon, and Meta which have full view of their own data and provide hashed insights to partner companies. Another approach relies on building independent, shared data clean rooms where publishers and advertisers can pool data for collective use; these too are not independent. AWS (“Amazon Web Services”), for example, allows companies to create their own hosted clean rooms or to collaborate with other companies in a pool room.

Focusing on data, atomistically, is a losing battle. Even if data protection improves, inferences may remain unprotected or poorly protected. Accounting for inferences requires recognizing the networked and collective nature of inferences. Inferences are relational, where people’s decisions and behaviors are linked to each other to form intimate,

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133 For a sketch of what data unions are, see Maggie Appleton, Are Data Unions the Future of Data?, MAGGIE APPLETON, https://maggieappleton.com/data-unions [https://perma.cc/BUK2-Y9EU].


135 See Herbrich, supra note 134.


138 See Viljoen, supra note 6; Solow-Niederman, supra note 2.
interlinked profiles that cannot be disentangled. Even if we take steps to protect our own privacy, our life is still exposed based on the behaviors of others around us or like us. Salomé Viljoen argues against civil libertarian approaches to data that place ownership and control into individual hands, instead advocating for data as a type of public resource with collective responsibilities. The aim then is not to figure out what should not be done with data, but what kinds of public governance and social coordination data can enable.

The idea that individuals should control or own their data through some economic incentive (e.g., paying people for their data) has been routinely critiqued in privacy law. This is nothing new. Our point is that collective approaches to managing data and inferences require technical infrastructure that will end up relying on the same large players that exist today. The level of investment required to sustain a public information infrastructure alternative is so vast as to seem inconceivable. Alicia Solow-Niederman says, “the inference economy imbues those who can collect data and those who can process data into information with power.” The people—the users and consumers in such economies—are left on the short end of that imbalance of power, where the only option for participating on the Internet is to acquiesce to data collection and processing.

C. Inferences as diagnostic

In targeted ads, inferences are viscerally experienced because they are fed directly back to people—they’re about what users do see. People see the prediction an algorithm has made about them, but typically do not know why the algorithm made the prediction it did. If we see cancer ads and believe ourselves to be healthy, should we go see a doctor? Does the algorithm know something we do not? If we have been feeling down lately and see ads for depression treatment, should we interpret that as a diagnosis? While there has been study of the diagnostic nature of user-

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139 See Viljoen, supra note 6.
140 Id.
141 Id.
142 See Kaminski, supra note 50.
143 See Solow-Niederman, supra note 2, at 400.
144 See Wachter & Mittelstadt, supra note 2; Solove, supra note 36; Turow et al., supra note 63.
145 In the case of some groups not seeing housing or employment opportunities in their news feed, recognizing cognizable harm has required recognizing what those groups systematically don’t see. See Angwin & Parris, Jr., supra note 122; Ali et al., supra note 7.
146 The engineers who developed the algorithms may not be able to explain why a prediction is made either. Deep learning is sufficiently complex that it is difficult to inspect inputs and outputs, which makes auditing inferences especially challenging.
generated content and of search engine results (e.g., TikTok users self-diagnosing illnesses, Google search users seeing racist results), there has been less of a focus on the diagnostic nature of targeted ads.\textsuperscript{147}

Self-diagnosis may be a practice we can recognize as sometimes harmful as a society (and sometimes beneficial), but which the law has not been inclined to address. As long as products are not designed or advertised in ways that are negligent or deceptive, they can be advertised to consumers.\textsuperscript{148} On the consumer side, a self-diagnosis rarely has legal standing (e.g., it will not trigger disability accommodations). Self-diagnosis can be a powerful practice. Instinct can motivate a person to go to the doctor and get the healthcare they need; it can also be confusing, misleading, or even experienced as threatening. Our data indicated how people felt those feelings and more when targeted ads for sensitive health related topics. However, the solution is not for users to be more informed, to be better prepared, or to take more preventive measures against the ads that are targeted to them.\textsuperscript{149} Informed consent is intended to be the individual user’s bargaining chip, or the price they pay for using services, as an expression of self-determination, but people cannot consent to an agreement they do not understand. Consent may not be a fair bargain even if they could. Internet services are essential and opting out is rarely a reasonable option.\textsuperscript{150} Regulatory and industry efforts have shifted towards the concept of transparency—Apple, Google, and Amazon now have dedicated ad and tracking transparency pages that promote choice, safety, and openness\textsuperscript{151} while regulatory efforts like the Honest Ads Act would require large digital platforms to maintain a public file of election related

\textsuperscript{147} See Noble, supra note 57; Milton et al., “I See Me Here”: Mental Health Content, Community, and Algorithmic Curation on TikTok, PROCEEDINGS OF THE 2023 CHI CONFERENCE ON HUMAN FACTORS IN COMPUTING SYSTEMS 1, 1 (2023); Christina Caron, Teens Turn to TikTok in Search of a Mental Health Diagnosis, N.Y. TIMES (Oct. 29, 2022), https://www.nytimes.com/2022/10/29/well/mind/tiktok-mental-illness-diagnosis.html [https://perma.cc/LXB9-NSLG].


These efforts put some control into users’ hands, but still suffer from the problem of user burden. Can we realistically expect users to make informed choices about all of the devices, apps, and websites they use within an ad ecosystem that they do not understand?

Even when people are told about what is being done with their data, information asymmetry gaps exist between what people understand and what companies receive permission to do. The idea of inferences is even more asymmetric—the data that feeds deep learning models and the models themselves are black boxes. Targeted ads may be imbued with perceived legitimacy because they are generated by the site, not by other users. The problem is not that people are exposed to topics that may be sensitive for them, which happens regularly in everyday life. The problem is that algorithms are targeting sensitive topics to them which, as our results indicate, may be perceived as diagnostic and legitimate. Recent reforms have focused on the idea that firms should use personal data only for the purpose for which it was collected and no other reason unless they say otherwise. Any reforms to privacy or consumer law intended to address sensitive inferences will have to contend with advertising itself being the purpose.

V. CONCLUSION

Inferences are sensitive, intimate, private, and personal. As we have shown, they vary between individuals and current metrics for delivering ads are not particularly good proxies for people’s comfort. Competing stakeholders point to the benefits and risks for people in their arguments for or against targeted ads. Our results demonstrate how treating concepts like data sensitivity as binary fails to recognize sensitivity and comfort of

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154 Ads are not generated by the site but by a vast and complex ad exchange industry; the statement here is simply that everyday users may not understand that industry and may believe websites have explicitly vetted the ad.
155 See Citron, supra note 19; Kyi et al., supra note 44.

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its inferences. There are a few considerations for moving forward. We could explore the idea of sensitive inferences as a concept that requires protection. We could consider whether user comfort should be better recognized and protected, either through policy or through interface design choices, while recognizing that notice and choice has been a largely failed design experiment for protecting user rights. We could construct public resources to oversee the collection and management of our personal data, though the resources and infrastructure required to do so would be enormous. Finally, the concept of inferences should be prioritized as a first-order concern just as data has been.