The Facebook Algorithm's Active Role in Climate Advertisement Delivery

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Communication strongly influences attitudes on climate change. Within sponsored communication, high spend and high reach advertising dominates. In the advertising ecosystem we can distinguish actors with adversarial stances: organizations with contrarian or advocacy communication goals, who direct the advertisement delivery algorithm to launch ads in different destinations by specifying targets and campaign objectives. We present an observational (N=275,632) and a controlled (N=650) study which collectively indicate that the advertising delivery algorithm could itself be an actor, asserting statistically significant influence over advertisement destinations, characterized by U.S. state, gender type, or age range. This algorithmic behaviour may not entirely be understood by the advertising platform (and its creators). These findings have implications for climate communications and misinformation research, revealing that targeting intentions are not always fulfilled as requested and that delivery itself could be manipulated.

advertising | climate change | social media | polarization

In 2022, the Intergovernmental Panel on Climate Change (IPCC) identified "rhetoric, misinformation, and politicization of science" as key barriers to climate action. The report, accepted by all members of the IPCC, stated explicitly that "vested economic and political interests have organized and financed misinformation and contrarian climate change communications". Scholars across disciplines have documented the deceptive nature of contrarian climate communications (1–15). Many of these studies (and the IPCC report) focus on communication through traditional media - print and broadcast (16–23), while climate discourse also occurs on social media platforms such as Twitter and Facebook. Like all discourse on social media platforms, climate discourse occurs "organically" through user content posts, up-voting, and sharing. It also occurs through advertising.

Studies of climate discourse on social media platforms, have the unique opportunity to examine and report about platform users and advertisers in greater detail than in print or broadcast media. They are able to characterize the demographics of both users and advertisers, answering questions such as *who is paying for content? how much are they spending? where are they targeting campaigns?*, and *where are ads delivered and to whom in terms of age and gender?*. This more granular demographic knowledge can potentially improve the effectiveness of online climate action campaigns, support litigation(24), and help inform effective inoculation and communication strategies against climate disinformation (24–28), (29–31).

This contribution examines climate related advertising activity(more succinctly, climate ads) on Facebook. Noting the adversarial nature of climate ad activity between actors who can be considered contrarians or advocates, our investigation starts with observational data – the data provided by Facebook of its historical advertising delivery activity. We are able to divide the data by adversary – ads sponsored by contrarians and ads sponsored by advocates. To consider the impacts of engagement, we subdivide the data for each adversary by the magnitude of impressions. This axis, related to delivery volume, linearly relates to advertising spend.

Along the impression axis, beyond asking *"who?"*, *"where?"*, and indirectly *"how much?"*, we also investigate the possible presence of algorithmic bias. Current studies have restricted the notion of climate actors to underlying trade, organizational, and financial organizations influencing climate discourse. However, the algorithms and recommendation systems on social media may also deserve recognition as actors influencing climate discourse. Is it possible that Facebook's advertising algorithmic decision system (more succinctly, ADS or algorithm) is itself a climate discourse actor of significance? Like most digital advertising platforms, Facebook's ADS is designed to provide maximum engagement for the cheapest cost. Micro-targeting features that deliver ads to users most likely to engage with an advertiser's content enable advertisers - both contrarians and advocates, to act with detailed intentions. Facebook's ad algorithm has previously been shown to exhibit gender, racial, and political bias (32–36). For example, when the algorithm is tasked with delivering political ads for Democratic and Republican candidates, it tends to deliver them in larger quantities to Democratic and Republican voters respectively (33), even when no targeting parameters are specified. Similarly, advertising algorithms have been shown to "see colour", propagating communications featuring individuals of a particular race to Facebook audiences of the same race(35); "see gender", propagating communications featuring objects of stereotypical interest to males and females to Facebook audiences of the same gender(32). These algorithms have also been shown to influence labour(37). Because algorithmic bias can accelerate the spread of disinformation(38), in this contribution we first examine algorithmic bias while comparing advocacy ad and contrarian ad activity in observational data.

Detecting algorithmic bias requires complete transparency of target intent and ad delivery. Effectively, for 2 types of content if the same targeting parameters result in different delivery patterns, this constitutes algorithmic bias, interference, or skew. Our observational study turns out to be partially adequate to detect algorithmic skew. The data provided by Facebook only documents delivery statistics, and does not provide the corresponding campaign information entered by its advertisers. This obscures their intentions around targeting. Advertisers may choose specific or general targeting parameters to distribute an ad. In some circumstances, such as

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when we observe ads going only to one state or to users of a single gender or age segment, we can surmise an intent to target and the target itself. When ads are delivered to all possible locations or user segments, we can surmise there has been no intent to target. In other circumstances, advertiser intentions remain obscure. Within these constraints and with these surmissions, we find apparent algorithmic skew.

Therefore, to more fully investigate skew and assess whether it influences ad delivery, we conduct an experiment where we assume the role of (under controlled and ethical conditions) an advertiser, thus making the intent of targeting totally transparent. With details found in Section 2, to uncover the foundations of bias, we design the simple and informative experiments. This points to ads completely consisting of images, given that past experiments demonstrate that ad delivery can be significantly affected by the image alone. Choosing just two objects for ad images, one featuring an oil rig, i.e highly negatively aligned with climate action, and the other featuring a solar cell, i.e highly positively aligned with climate action, drawn from contemporary ads on Facebook, we completely ablate specific state, gender or age targeting parameters. This leaves the fate of these two "experimental probes"' delivery entirely to Facebook's algorithmic decision system. Subsequently checking for differences in the delivery of ads featuring these two object in U.S. state, gender, and age based ad destinations, teases out apparent algorithmic bias. We go on to analyze whether affixing the logos of contrarian or advocacy actors on an ad image impacts delivery in ad destinations, and if the delivery we observe in an ad destination is proportional to Facebook's estimates of audiences in these destinations. Finally, we discuss the implications of such algorithmic decision making on climate communication, and the climate discourse.

This work is divided into two sections. Section 1 presents an observational study of climate ads on Facebook between May 2018 - May 2023, paying close attention to delivery patterns. The analysis of the observational data is done with respect to different advertisement destinations (age, gender, location) and for different ad targeting strategies (targeted and non-targeted) as surmised from the data. Section 2 presents an experimental study to isolate the influence of the algorithm on delivery. We launch climate ads yielding full control of the delivery to the Facebook advertising algorithm and report results. The results show preferential delivery emerging solely from the type of ad content featured, in ad destinations characterized again by age, gender, and location. We discuss the implications of the algorithm's active role in the last section.

1. An Observational Study of Past Climate Ads

We conduct an observational study of 274K climate ads delivered on Facebook in the U.S. We first define terms pertaining to digital advertising. We go on to identify contrarian and advocacy actors, and assemble a dataset of past ads from these actors. We finally analyze the differences between the delivery patterns of advocacy and contrarian ads.

Digital advertising uses specific vocabulary. An advertiser publishes an ad along with 'targeting' parameters that describe the intended audience. These can be the gender, age, location, interests, or even personally identifiable information of an audience group. Advertisers also specify 'optimization criteria'

to maximize the returns from an advertisement. For example, an advertiser could request the platform to maximize the ad view/ad click count, or increase traffic towards a website or a store. Lastly, advertisements contain 'delivery' information. It is similar to the targeting information, but is inserted after the Facebook platform has delivered the ad. It describes the gender, age, and location compositions of audiences who were shown the ad. Delivery information also includes ad impressions, a value which describe the number of times the ad was shown on screen. The dataset we analyze does not contain targeting information or optimization criteria associated with an ad. It does contain partial delivery information: the location, gender, and age composition of an ad audience and the range of impressions received and expenditure made on the ad. We analyze this delivery information later in this section.

1.1 Dataset To assemble our dataset, we begin by creating a list of contrarian and advocacy actors identified by peer-reviewed research(39–41). Contrarians are restricted to fossil fuel corporations and groups who advertise on their behalf, and advocates are restricted to environmental groups and renewable energy providers. Any ad published by these groups is considered a 'climate' ad. We extract 81,248 ads published by 260 contrarian actors and 171,877 ads published by 482 advocacy actors between May 2018 - May 2023. Collectively, the ads in our dataset are viewed for 1.36M days, shown between 5.4B - 6.4B times on screen, and involve an expenditure of $79M - $133M. We remove duplicate ads and ads delivered to locations outside the U.S. to yield 63,542 contrarian and 139,012 advocacy ads. We sub-divide and aggregate these ads by impression counts (See Appendix 9.2 for a full list of 39 impression classes) into 5 groups: ads receiving $< 1K$, $1K - 10K$, $10K - 100K$, $100K - 1M$, $1M+$ impressions; See 9.1 for a link to the dataset.

After assembling the dataset, we analyze it. Ignoring the content of an ad, we focus our attention on the delivery information. We now describe possible ad destinations and corresponding delivery information, and proxies to surmise targeting intent from delivery.

Ad Destinations and Delivery Information Each ad in the dataset contains attributes describing delivery information for three ad destinations: U.S. states, gender, and age.

- *U.S. States* - The `delivery_by_region` attribute of each ad contains delivery information for U.S. state destinations. This attribute is a list of N tuples, $N \in [1, 52]$. The ith tuple is $(\texttt{region}_i, \texttt{delivery\_percentage}_i)$, where $\texttt{region}_i$ can be one of 52 locations, comprising 50 U.S. states, Washington D.C and an 'Unknown' category, and $\texttt{delivery\_percentage}_i$ is a fraction such that $\texttt{delivery\_percentage}_i \in [0, 1]$ and $\Sigma_{i=1}^{52}\texttt{delivery\_percentage}_i = 1$.

- *Age and gender destinations* - The `demographic_distribution` attribute of each ad contains delivery information for age and gender destinations. This attribute is a list of N tuples, $N \in [1, 24]$. The ith tuple is $(\texttt{gender\_i}, \texttt{age\_i}, \texttt{delivery\_percentage}_i)$, where $\texttt{age\_i} \in [18\text{-}24, 25\text{-}34, 35\text{-}44, 45\text{-}54, 55\text{-}64, 65+]$ and $\texttt{gender\_i} \in [\text{male, female, unknown}]$. $\texttt{delivery\_percentage}_i$ is a fraction such

	Contrarians	Advocates
Expenditure ($)	$34M - $47M	$45M - $67M
Impressions	1.9B - 2.2B	4.5B - 6.7B
Impressions/$	40 - 64 impressions/$	52- 91 impressions/$
Top 5 targeted states (In order)	Texas, Michigan, New Mexico, Pennsylvania, Colorado	Michigan, California, Pennsylvania, North Carolina, Colorado
Top 5 non-targeted states (In order)	Texas, Florida, Ohio, Pennsylvania, North Carolina	California, New York, Florida, Texas, Pennsylvania
Top 5 states overall (In order)	Texas, Florida, Pennsylvania, Ohio, California	California, New York, Florida, Texas, Pennsylvania

Table 1. Comparisons of ad impressions and ad spend for contrarians and advocates

that $\texttt{delivery\_percentage}_i \in [0,1]$ and $\Sigma_{i=1}^{52}\texttt{delivery\_percentage}_i = 1$.

The delivery information reveals the audiences reached by the contrarians and advocates, their locations, and indicates the role of the algorithm in ad delivery. We would ideally use both targeting and delivery information associated with an ad, to uncover these insights. However, while the dataset contains delivery information along three ad destinations - U.S. states, age, and gender - it contains no targeting information. We therefore use proxies in the delivery data to deduce targeting intent.

Targeting Proxies We consider two proxies to surmise the presence or absence of targeting intent. Ads delivered to only one U.S. state, gender or age destination are assumed to be targeted by the advertiser, and called 'Targeted' ads. Ads delivered to audiences that are diverse in composition, i.e ads delivered to at least 48 U.S. states[*] and to all genders and age groups are called 'Non-targeted' ads. We hypothesize that the role of algorithmic decision making is visible in the delivery patterns of ads reaching audiences of diverse compositions based on findings in past research(32, 33, 37)[†].

1.2 ANALYSIS We use the delivery information data to analyze and compare the advertising behaviours of contrarians and advocates in the overall dataset across state, age, and gender based ad destinations. We also analyze delivery patterns from the two groups for different targeting strategies as defined by our targeting proxies. The methods used for the analysis are outlined in 9.5.

1.2.1 ANALYSIS OF ALL ADS There are a total of 63,542 climate contrarian ads and roughly twice as many climate advocacy ads (139,012) in the ads dataset. We investigate the delivery percentage samples of advocacy and contrarian ads for each U.S. state, gender, and age based ad destination (See Fig 1). The delivery percentage samples tell us how contrarian and advocate ads are delivered on priority to different state, age, and gender based destinations - the higher the delivery percentage the more highly a destination was prioritized during delivery. Table 1 contains a list of states ranked by their prioritization across various targeting parameters in the dataset.

1. U.S. State Destinations - On average, delivery percentages of contrarian ads are higher than delivery percentages of

advocacy ads. This indicates that contrarians run ads are delivered on priority to a single U.S. state or a few U.S. states as compared to advocates who run ads delivered to a larger cluster of states, across all impression categories. Advocates change strategy to prioritize delivery to a single state when running high-impression ads ($> 100K$ impressions), but still lag behind contrarians in effectiveness (See Fig 1a and 1b). See tables 2, 3, 4, 5, and 6 for the values from our statistical analyses.
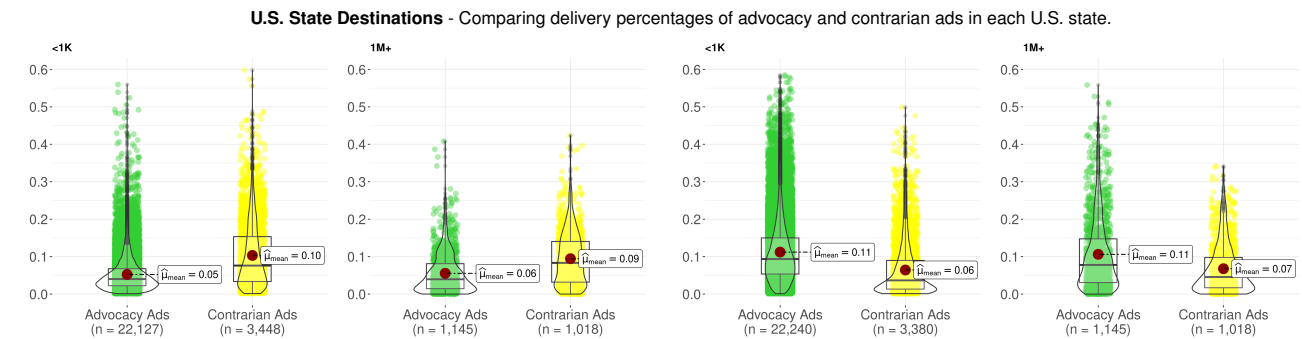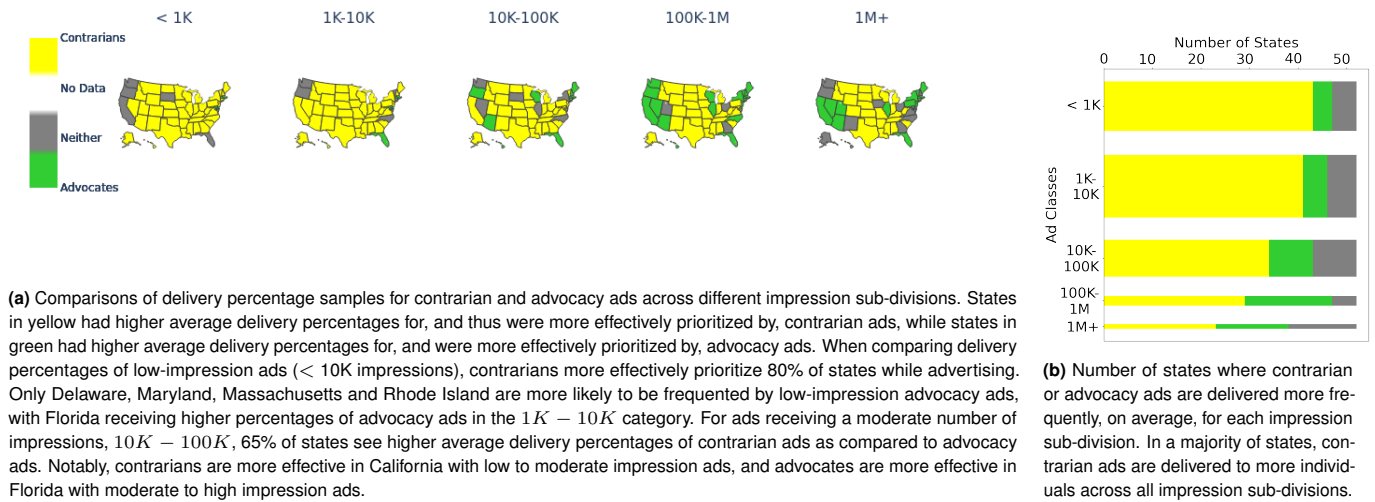
2. Gender Destinations - On average, contrarians prioritize delivering their ads to males, while advocates prioritize delivering their ads to females across all impression classes (See Fig. 1c and 1d). See table 17 for values from our statistical analyses.

3. Age Destinations - On average, contrarians prioritize delivering their ads to older audiences while advocates prioritize younger audiences. Facebook audience estimates suggest that the largest group of users on the platform are in the ages of 25-34, with users over the age of 65 being the smallest group, suggesting that a larger fraction of older individuals are receiving contrarian advertisements (See Fig. 1e and 1f). See table 20 for values from our statistical analysis.

1.2.2 ANALYSIS OF TARGETED ADS We investigate the delivery percentage samples of advocacy and contrarian ads that were delivered to at most 1 U.S. state, gender, or age destination (See Fig 2a and 2b)

1. U.S State Destinations - 36K (56%) contrarian and 46K (33%) advocacy ads are targeted at a single U.S. state (Fig. 2a). Particularly, Texas, New Mexico, Alaska, Louisiana, Colorado, Iowa, Montana, New York, and Utah receive a higher number of targeted contrarian ads in multiple impression sub-divisions, in spite of our dataset having twice as many advocacy ads as contrarian ads. The fraction of targeted ads being delivered to a state, advocates dominate in most states. See tables 7, 8, 9, 10, and 11 for the exact values used in our analyses.

2. Gender Destinations - 2,591 (3.1%) contrarian ads and no advocacy ads, roughly 60% of these were delivered to males, and 40% were delivered to females. On average, contrarian ads receiving $< 1K$ impressions were delivered in higher percentages to females while in all other impression categories, they were delivered in higher percentages to males. The ads targeted at females went to all states, but predominantly to Alaska, Arizona, California, Texas, and Florida The ads targeted at males went to all states,

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[*] Facebook delivers ads to 52 locations – 50 states, Washington D.C. and an 'Unknown' category. In 700 campaigns targeted at audiences across U.S. states, genders and ages, we found that while the ad was always delivered to audiences belonging to all gender and age categories, sometimes ads were only delivered to 48 locations. Changing this to other values between 48 and 52 had little effect on our findings.

[†] The role of the algorithm is visible even when advertisements are targeted using advertiser-controlled targeting features such as personally identifiable information based targeting or custom audience list based targeting.

(a) Comparisons of delivery percentage samples for contrarian and advocacy ads across different impression sub-divisions. States in yellow had higher average delivery percentages for, and thus were more effectively prioritized by, contrarian ads, while states in green had higher average delivery percentages for, and were more effectively prioritized by, advocacy ads. When comparing delivery percentages of low-impression ads ($< 10K$ impressions), contrarians more effectively prioritize 80% of states while advertising. Only Delaware, Maryland, Massachusetts and Rhode Island are more likely to be frequented by low-impression advocacy ads, with Florida receiving higher percentages of advocacy ads in the $1K - 10K$ category. For ads receiving a moderate number of impressions, $10K - 100K$, 65% of states see higher average delivery percentages of contrarian ads as compared to advocacy ads. Notably, contrarians are more effective in California with low to moderate impression ads, and advocates are more effective in Florida with moderate to high impression ads.

(b) Number of states where contrarian or advocacy ads are delivered more frequently, on average, for each impression sub-division. In a majority of states, contrarian ads are delivered to more individuals across all impression sub-divisions.

U.S. State Destinations - Comparing delivery percentages of advocacy and contrarian ads in each U.S. state.

(c) Males receive higher delivery percentages of contrarian ads on average across all impression classes.

(d) Females receive higher delivery percentages of advocacy ads on average across all impression classes.

Gender Destinations - Comparing delivery percentages of advocacy and contrarian ads for gender-based ad destinations. Only the lowest and highest impression class are shown here.

(e) Younger audiences receive higher delivery percentages of advocacy ads on average across all impression sub-divisions.

(f) Older audiences receive higher delivery percentages of contrarian ads on average across all impression sub-divisions.

Age Destinations - Comparing delivery percentages of advocacy and contrarian ads for age-based ad destinations. Only the lowest and highest impression class are shown here. Delivery samples of advocacy and contrarian ads are significantly different across all impression sub-divisions, but the effect size (Cohen's d) is small for low-impression ads.

Fig. 1. ALL ADVERTISEMENTS Comparing delivery percentages of advocacy and contrarian ads across different ad destinations for all ads in the dataset.

but predominantly to Alaska, California, Hawaii, Kentucky, and Louisiana The contrarian ads targeted at males were more frequently delivered to older audiences while those targeted at females were more frequently delivered to younger audiences. See table 18 for the exact vaues from our analyses.
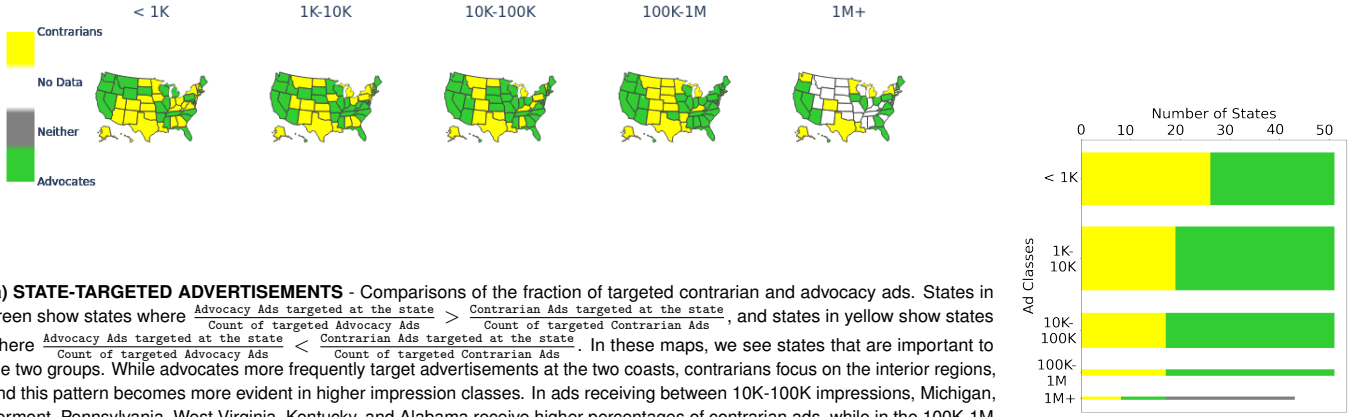
(a) STATE-TARGETED ADVERTISEMENTS - Comparisons of the fraction of targeted contrarian and advocacy ads. States in green show states where $\frac{\text{Advocacy Ads targeted at the state}}{\text{Count of targeted Advocacy Ads}} > \frac{\text{Contrarian Ads targeted at the state}}{\text{Count of targeted Contrarian Ads}}$, and states in yellow show states where $\frac{\text{Advocacy Ads targeted at the state}}{\text{Count of targeted Advocacy Ads}} < \frac{\text{Contrarian Ads targeted at the state}}{\text{Count of targeted Contrarian Ads}}$. In these maps, we see states that are important to the two groups. While advocates more frequently target advertisements at the two coasts, contrarians focus on the interior regions, and this pattern becomes more evident in higher impression classes. In ads receiving between 10K-100K impressions, Michigan, Vermont, Pennsylvania, West Virginia, Kentucky, and Alabama receive higher percentages of contrarian ads, while in the 100K-1M category, this is reduced to Kentucky and Michigan. In the category of ads receiving 1M+ impressions, Washington, Texas, Alaska, Louisiana, Minnesota, Michigan, Colorado, New York are dominated by contrarian ads. Alaska, one of the smallest states by Facebook user counts is a contrarian stronghold through and through. Similarly, Florida seems to be consistently dominated by advocacy advertisements.

(b) Count comparisons for states where contrarians and advocates target ads more frequently, across different impression classes.

Fig. 2. TARGETED ADVERTISEMENTS Comparisons of targeted contrarian and advocacy ads

3. Age Destinations - 248 (0.3%) contrarian ads and 0 advocacy ads employ age group based targeting strategies.

1.2.3 ANALYSIS OF NON-TARGETED ADS We filter a set of 7.5K contrarian ads and 44K advocacy ads that are not-targeted, i.e ads that reached > 48 U.S. states, all 3 genders, and 6 age groups (See Fig.3a and 3b). We hypothesize that the delivery of this set of ads is influenced by algorithmic decision making[‡]. We compare delivery percentages in each location, gender, and age based ad destination.

1. U.S. State Destinations – Delivery percentages of contrarian and advocacy ads in this category are evenly distributed across all states in the U.S., with contrarians having a slight edge over advocates in a large number of states and impression sub-divisions (See Fig. 3a). States receiving higher percentages of contrarian or advocacy ads are strongly correlated to a state's likelihood to vote Republican or Democrat respectively based on voting patterns in the last 4 elections (Cramer's V correlation, $\phi_c = 0.73$). See tables 12, 13, 14, 15, and 16 for the exact values from our analyses.

2. Gender Destinations – There is a significant difference between the delivery percentages of contrarian and advocacy ads among males, females and audiences whose gender are unknown to Facebook. Among females, and those of unknown gender, advocacy ads are delivered in higher percentages than contrarian ads and among males, the converse is true. See table 19 for the exact values from our analyses.

3. Age Destinations – There is a significant difference between the delivery percentages of contrarian and advocacy ads among audiences of all age groups. We observe that advocacy ads are delivered in higher percentages to audiences of younger age groups while contrarian ads are delivered in higher percentages to audiences of older age groups. See table 22 for the exact values from our analyses.

1.3 Discussion We analyze the distribution of climate advertisements on Facebook in the last 5 years, and show that in spite of advocacy ads being higher in number, and costing lesser to advertise overall (See Table 1), contrarian ads seem to be employing more effective location, gender, and age-group based targeting. Further, upon investigating targeted contrarian ads, we reveal that contrarians and advocates prioritize a small set of states. Texas, Florida, Pennsylvania and California are states prioritized by both contrarians and advocates(See Table 1).

Secondly, we find a linear relationship in the dataset between the spend made on an ad and the impressions received, suggesting that our findings from the observational study would hold true, even if we sub-divided ads based on the spend instead of the impressions.

Lastly, we find evidence indicating, but not concluding, that Facebook's advertising algorithm enables this difference in delivery patterns across ad destinations. The dataset from the study only provides the range, and not the absolute values, of ad impressions received and ad spends made on each ad. To clarify the role of the algorithm in determining delivery and spend, we design and launch ads that are controlled for both targeting and spend parameters. We analyze the delivery ensuing from these campaigns, and report cases of preferential delivery enabled by the algorithm.

2. An Experimental Study of Non-Targeted Ads

In this section, we conduct an experimental study to investigate the role of algorithmic decision making in the delivery of climate ads, without directed targets for age, gender, or location based ad destinations. Algorithmic decision making

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[‡] While Facebook does allow for personally identifying information (PII) based targeting and targeting using custom audiences which may well have influenced this category of ads, past research has shown that algorithms exert a statistically significant influence even when there is PII or custom-audience based targeting(32–36) especially when the number of ad destinations are large in number
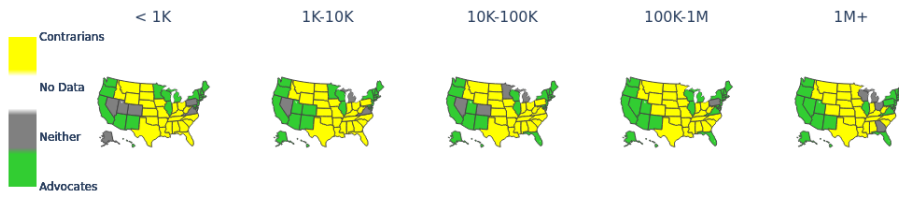
(a) States in yellow had higher average delivery percentages for, and thus were more effectively prioritized by, contrarian ads, while states in green had higher average delivery percentages for, and were more effectively prioritized by, advocacy ads. Advocacy ads have higher average delivery percentages in states along the coasts, while contrarian ads have higher delivery percentages in the interior regions.
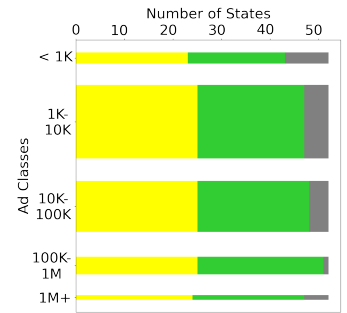
(b) Number of states where contrarian or advocacy ads are delivered more frequently on average for each impression sub-division. Contrarian ads are more frequent in a slightly larger number of states in all impression sub-divisions except the 100K-1M category.

U.S. State Destinations - Comparing delivery percentages of non-targeted advocacy and contrarian ads in each U.S. state destination.
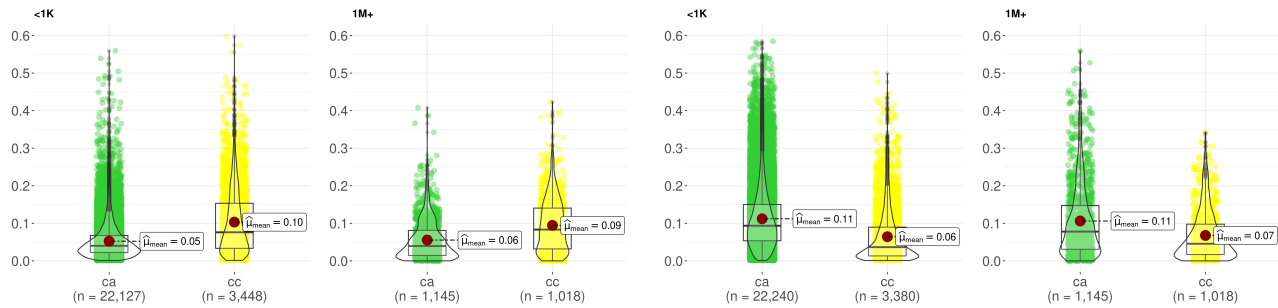
(c) Males receive higher delivery percentages of, and are more effectively prioritized by, climate contrarian ads on average

(d) Females receive higher delivery percentages of, and are more effectively prioritized by, climate advocacy ads on average

Gender Destinations - Comparing delivery percentages of advocacy and contrarian ads for gender-based ad destinations. Only the lowest and highest impression classes are shown here.
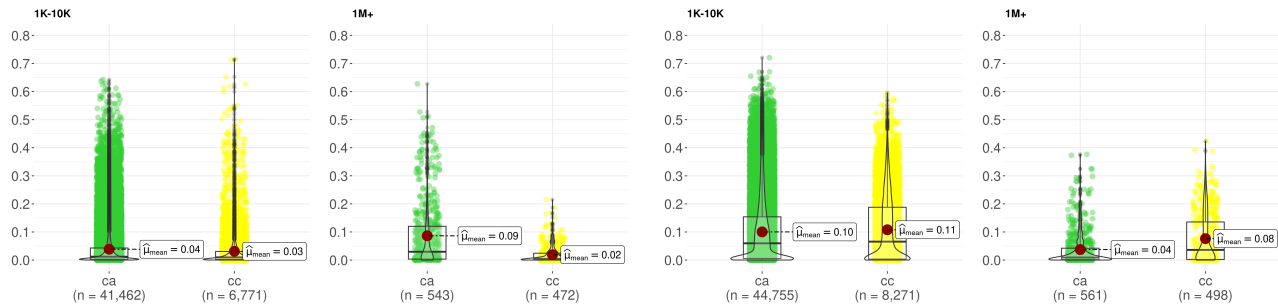
(e) Younger Audiences

(f) Older Audiences

Age Destinations - Comparing delivery percentages of advocacy and contrarian ads for age-based ad destinations. Younger audiences receive higher delivery percentages of, and are more effectively prioritized by, advocacy ads and older audiences receive higher delivery percentages of, and are more effectively prioritized by, contrarian ads. However the effect size (Cohen's d) is small in the lower impression sub-divisions.

Fig. 3. NON-TARGETED ADVERTISEMENTS Comparing delivery percentages of advocacy and contrarian ads across different ad destinations for non-targeted ads in the dataset.

plays an invisible but important role in the delivery of digital information. Past research shows that ads related to elections, labour, and social issues are delivered preferentially to certain audience groups(32, 33, 35, 37). We are interested in investigating the existence of bias, and quantifying it, in the delivery of climate ads. We now describe our experimental design and

probes, investigative methods, research questions, the main findings, and a detailed analysis of the results.

(a) Oil rigs   **(b)** Solar cells   **(c)** Controls

Fig. 4. Images without logos

(a) Oil rigs   **(b)** Solar cells   **(c)** Controls

Fig. 5. Duplicate of images without logos for a consistency check

(a) Oil rig + Contrarian Logo   **(b)** Solar cell + Contrarian Logo   **(c)** Oil rig + Advocacy Logo   **(d)** Solar cell + Advocacy Logo

Fig. 6. Images with contrarian and advocacy logos

3. Experiment

We create 650 ads containing images, but no text (See fig. 7). This sample size is chosen based on an *a priori* power analysis, which suggests selecting 65 images per group to uncover a small to moderate effect size of 0.25, with power=0.8. Ad images are sourced from the three experimental groups described below. We do not use any special ad targeting features provided by Facebook, i.e we request that the ads be delivered impartially to audiences in all U.S. states, and of all genders and ages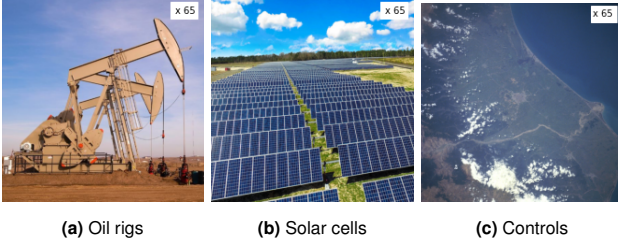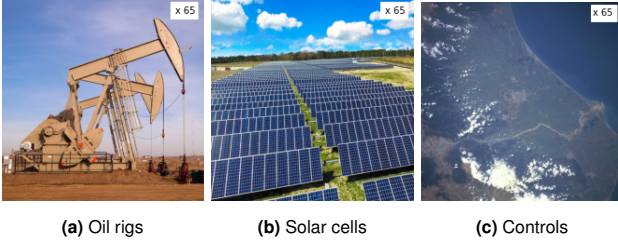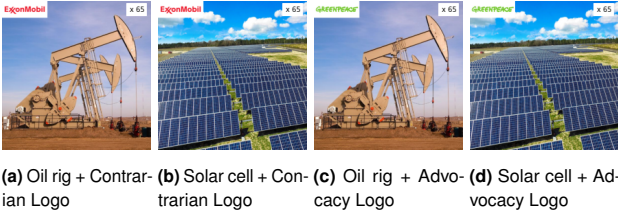. We launch the ads for a period of 24 hours, and ask Facebook to optimize delivery to reach audiences likely to click on them. This is similar to prior research (32). When a Facebook user clicks on the ad, they are taken to a website. At the end of the 24h experiment, ad metadata is collected from Facebook and comparisons are made between the delivery information of contrarian vs advocacy ads. Given that we run ads yielding full control over the ad targeting to Facebook, we measure the Delivery Ratio, D^R. D^R includes both the observed delivery during the experiment and the expected delivery (which is derived from Facebook's ad audience estimates). To calculate D^R, first, the 'Reach' information is collected for all launched ads. This contains the count of unique Facebook accounts that were shown one of our launched ads. This value is collected for each ad destination (U.S. state, gender, and age). Second, Facebook's self-reported population estimates for various ad destinations are collected. These provide a measure of the expected delivery count that is proportional to the audience size matching an ad destination. Facebook also advertises

these population estimates as being the population sizes from which an ad audience sample will be drawn. The 'Delivery Ratio' (D^R), is given by $D^R_{ci} = \frac{O_{ci}}{E_{ci}}$. Here, $D^R \in \mathbb{R}^+$, and $O_{ci}, E_{ci} \in \mathbb{N}$. O_{ci} is the unique number of times an ad i was shown in an ad destination(U.S. state, gender, or age) c, and E_{ci} is Facebook's estimated reach of the ad for the same category.

3.1 Experimental Groups We design 3 experimental groups to investigate differences in delivery.

1. **Images** - Solar cells (65 images) and oil rigs (65 images) without any additional modifications. Additionally, two other sub-groups we consider in the *Images* category are the following:

   (a) **Controls** - Control images (65 images)

   (b) **Duplicates** - Duplicate ads using images from the *Images* and *Controls* group to check that delivery is consistently caused by ad content (65 images x 3).

2. **Images + Contrarian Logo** - Solar cells and oil rigs with the logo of a contrarian organization on the top left (65 images x 2).

3. **Images + Advocacy Logo** - Solar cells and oil rigs with the logo of an advocacy organization on the top left (65 images x 2).

We use images of oil rigs and solar cells in the experimental ads because these objects are found across the U.S., and featured in both contrarian and advocacy ads. While contrarians advertise oil rigs to highlight engineering capabilities and economic advantages, advocates use them to campaign against drilling. Similarly, contrarian ads use solar cells to highlight their contributions to climate action, and advocates use them to promote the use of renewable energy. 65 images featuring each of these objects are selected. A state-of-the-art image classifier(42) is able to distinguish our probes with high accuracy. We also sample 65 controls from the ImageNet-21K dataset, using a sampling process that excludes overlapping categories in the dataset. This ensures that controls are also able to be distinguished by a machine classifier. The algorithm to sample controls is provided in Appendix 9.8.

4. Research Questions

We pose the following research questions:

1. Does ad delivery ratio, D^R, differ based on the content of an ad image?

2. Does ad delivery ratio, D^R, differ when logos are present on an ad image? Is the effect similar for ads with solar cells and oil rig images?

3. Can observed ad delivery be consistently attributed to the ad image?

4. Is observed ad delivery proportional to Facebook's population estimates in all ad destinations?

(a) Oil rigs

(b) Solar cells

Fig. 7. Example ads featuring an oil rig and a solar cell.

5. Results

5.1 Main takeaways

1. Image matters: D^R is significantly different based on the content of an ad image, in 46% of U.S. states, and in all gender and age destinations.

2. Logo influences are modest: D^R is not significantly different for images featuring contrarian or advocacy logos. D^R is also not influenced by the presence or absence of a logo in nearly any ad destination. Audiences in certain age destinations – 18-24, 45-54, and 65+ – are sensitive to the type of logo used on a solar cell image; D^R is significantly different based on logo used in solar cell ads for these groups.

3. Ad delivery is consistent with ad image: The audience sizes of ads featuring the same image is consistently similar in 90% of the ads for U.S. state based ad destinations. In gender and age destinations, audience sizes are consistently similar for 100% and 99% of the ads we run respectively.

4. Observed audience sizes are not always proportional to Facebook's user populations: In U.S. state based ad destinations, audience sizes for *Controls* are more likely (64%) to be proportional to Facebook's population estimates than for images of solar cells and oil rigs (42.5%). In gender based destinations, audience sizes for Solar cells and oil rigs are more likely (67%) than controls (22%) to be proportional to Facebook's population estimates. In age based destinations, neither images of of solar cell and oil rig images (0%), nor controls (0%), are proportional to Facebook's population estimates.

5.2 Methods Most of the samples we collect from Facebook are not normal, but are largely homoscedastic. To answer RQ1 and RQ2, we therefore use the One-Way Kruskall-Wallis non-parametric test to look for significant differences in the D^R samples from different groups. Pairwise differences are further investigated using Dunn's Test with p-values adjusted using a Benjamini-Hochberg correction. To answer RQ3, we use Fisher's Test to investigate if the audience sizes in an ad destination is consistent when the same image is delivered twice. Lastly, to answer RQ4, we investigate if observed audience sizes are proportional to Facebook's self reported estimates using the Chi-Square Goodness of Fit Test with a Bonferroni correction.

5.3 Detailed Analysis

(a) Males

(b) Females

Fig. 8. D^R samples of ads featuring oil rigs, solar cells, and controls among male and female audiences. Note that images of oil rigs are delivered preferentially to males as compared to females. Similarly, images of solar cells are delivered preferentially to females as compared to males. The D^R samples further reveal that male audiences are over-represented ($D^R > 1$), and female populations are under-represented ($D^R < 1$) compared to their composition in the Facebook population.

5.3.1 RQ1: Does ad delivery ratio, D^R, change based on the content of an ad image?

We compare and investigate differences in the D^R samples of ads featuring solar cells, oil rigs and controls.

U.S. states In 38 states, the D^R sample of at least one of the three groups (Solar cells, oil rigs and controls) is significantly different from the others (N=650, p < 0.05, k=3). Upon investigating the pairwise differences, we find that, in 25 states, there's a significant difference (N = 520, p < 0.05) between the D^R samples of solar cells and oil rigs. In 30 states, there's a significant difference (N=390, p < 0.05) between the D^R samples of solar cells and controls and in 18 states there's a significant difference (N=390, p < 0.05) between the D^R samples of oil rigs and controls. See 9 for a map visualizing these states, and table 23 for the Kruskall-Wallis H Statistic

(a) Regions where the D^R of ads featuring solar cells is significantly different from the D^R of ads featuring oil rigs. Regions in orange are regions where $D^R_{\text{oil rigs}} > D^R_{\text{solar cells}}$, and regions in blue are regions where $D^R_{\text{solar cells}} > D^R_{\text{oil rigs}}$. There are 25 states where there's a significant difference between the D^R of ads featuring oil rigs and solar cells. In 88% of these states, the $D^R_{\text{oil rigs}} > D^R_{\text{solar cells}}$

(b) Regions where the D^R of ads featuring oil rigs is different based on the logo in the ad. Regions in yellow are regions where ads featuring contrarian logos had a higher median D^R (Idaho, New Mexico, Connecticut) and regions in green are regions where ads featuring advocacy logos had a higher median D^R.

(c) Regions where the D^R of ads featuring solar cells is different based on the logo in the ad. Regions in yellow are regions where ads featuring contrarian logos had a higher median D^R (South Dakota, California) and regions in green are regions where ads featuring advocacy logos had a higher median D^R (South Dakota, Montana, Michigan, New York).

Fig. 9

and p values.

Gender In both male and female audiences, the D^R samples of the three groups (solar cells, controls, or oil rigs) are significantly different(N=650, p < 0.05, k=2) as seen in Fig. 8. Upon investigating the pairwise differences, we find that in both male and female audiences, the D^R samples of oil rigs and solar cells are significantly different (N=520, p < 0.05, k=2), and of oil rigs and controls (N=390, p < 0.05, k=2) are significantly different. Further, ads featuring oil rigs are preferentially delivered to males while ads featuring solar cells are preferentially delivered to females. The D^R samples further reveal that male populations are over represented ($D^R > 1$) while female populations are under represented in the ad audiences selected by Facebook ($D^R < 1$). See table 24 for the Kruskall-Wallis H Statistic and p values.

Age The D^R samples of ads featuring solar cells, controls, or oil rigs (Fig 10) are significantly different (p < 0.05, N=650, k=3) in audiences belonging to all age groups (18-24, 25-34, 35-44, 45-54, 55-64, 65+). Upon investigating the pairwise differences, we find that except for audiences in the ages of 45-54, the D^R samples of solar cells and oil rigs are significantly different in all age groups (p < 0.05, N=520, k=2). Ads

(a) Audiences in the 18-24 age group

(b) Audiences in the 65+ age group

Fig. 10. D^R samples of ads featuring oil rigs, solar cells, and controls in younger and older audiences. Note that images of oil rigs are delivered preferentially to older audiences as compared to younger audiences. Similarly, images of solar cells are delivered preferentially to younger audiences as compared to older audiences. The mean D^R further reveals that older audiences are over-represented, and younger populations are under-represented, as compared to their composition in the Facebook population.

featuring oil rigs are preferentially delivered to older audiences while ads featuring solar cells are preferentially delivered to younger audiences. See table 25 for the Kruskall-Wallis H Statistic and p values. Additional sub-analyses can be found in Appendix 9.9

5.3.2 RQ2: Does ad delivery ratio, D^R, differ when logos are present on an ad image? We compare D^R samples of ads featuring images with a contrarian, advocacy, and no logos.

5.3.2.1 RQ2a: Does D^R differ based on logos present in an oil rig images?

U.S. states In 3 states (*Connecticut*, *New Mexico* and *Idaho*), we find a significant difference (N=260, p < 0.05) in the D^R samples of oil rigs containing different types of logos

(contrarian, advocacy, and none). Upon investigating the pairwise differences, we find that:

- In *New Mexico*, D^R samples of oil rigs with a contrarian logo are significantly different from those with an advocacy logo (N=130, p < 0.05).

- In *New Mexico*, *Connecticut*, and *Idaho*, D^R samples of oil rigs with a contrarian logo are significantly different from those with no logo (N=195, p < 0.05).

- In *Connecticut*, *New Mexico* and *Idaho*, D^R samples of oil rigs with an advocacy logo are significantly different from those with no logo (N=195, p < 0.05).

Values from our analyses are provided in table 26.

Gender D^R samples of oil rigs with different types of logos (contrarian, advocacy, none) are not significantly different in audiences of different genders. Values from our analyses are provided in table 27.

Age D^R samples of oil rigs with different types of logos (contrarian, advocacy, none) are not significantly different in audiences of different ages. Values from our analyses are provided in table 28.

5.3.2.2 RQ2b: Does the ad delivery ratio, D^R differ based on logos present in a solar cell image?

U.S. states In 6 states (*California*, *Michigan*, *Nevada*, *New York*, *Montana*, *South Dakota*), there is a significant difference (N=260, p < 0.05, k=3) in the D^R samples of solar cells containing different types of logos (contrarian, advocacy, and none). Upon investigating the pairwise differences, we find that: Upon investigating the pairwise differences, we find that:

- In *California* and *New York*, D^R samples of solar cells with an advocacy logo are significantly different(N=130, p < 0.05) from those with a contrarian logo.

- In *Michigan* and *South Dakota*, D^R samples of solar cells with an advocacy logo are significantly different (N=195, p < 0.05) from those with no logo. In these states, we further find significant difference (N=195, p < 0.05) between D^R samples of solar cells with a contrarian logo and those with no logo.

Gender D^R samples of solar cells do not significantly differ based on logo, in audiences of different genders.

Age D^R samples of solar cells do not significantly differ based on logo in nearly all age-based audience destinations. However, in audiences in the age groups, *25-44* and *65+*, we find a significant difference in the D^R samples of solar cells with a contrarian logo and those with an advocacy logo. In audiences in the age-groups, *18-34* and *65+*, the D^R samples of solar cells with no logos are significantly different from those with an advocacy logo.

5.3.3 RQ3: Can observed ad delivery be consistently attributed to the ad image? We test if the observed ad delivery can be consistently attributed to the ad image, by duplicating the ads featuring images without logos. This includes images of solar cells, oil rigs, and controls without logos. Since statistical tests that compare distributions of categorical variables rely on count values, we compare the 'Reach' of an ad and its copy among various ad destinations (U.S. states, gender, age).

U.S states   Audiences in many U.S. states receive 0 views of some ads, and several states receive < 5 views. To satisfy the assumptions of the Fisher's Test, we first group states based on Facebook's population estimates (See table 41). States that are expected to receive close to 0%, 1%, or 2% of the ad are grouped together (and their reach counts are summed), while states expected to receive greater than 2% of the ad are retained as is. This gives us 14 possible state destinations where an ad can be distributed. We use Fisher's Test to compare these observed delivery samples of an ad with its copy. In 89.7% of the ads, we find that the observed delivery sample of an ad is not significantly different from that of its duplicate (N = 195, p < 0.05). The exact values from our analysis are present in 29.

Gender   Among gender-based destinations, we find that in 100% of the ads, the observed delivery sample of an ad and its duplicate are not significantly different (N = 195, p < 0.05). The exact values from our analysis are present in 30.

Age   Among age-based destinations, we find that in 99% of the ads, the observed delivery sample of an ad and its duplicate are not significantly different (N = 195, p < 0.05). The exact values from our analysis are present in 31.

5.3.4 RQ4: Is the observed ad delivery proportional to Facebook's population estimates within U.S. state, age, and gender-based ad destinations?

U.S. states   In 47% of all ads, the observed delivery matches Facebook's population estimates(N=650, p < 0.05; See table 41 for population estimates by state.). The observed delivery of 64% of controls (N=130, p < 0.05), and 42.5% (N=520, p < 0.05) of non-control images (solar cells or oil rigs) matches Facebook's population estimates. The exact H-statistics and p-values are provided in tables 32, 33, and 34

Gender   The observed delivery of 28% of non-control images (oil rigs or solar cells, N = 520, p < 0.05) and 54% of control images (N=130, p < 0.05) matches Facebook's population estimates (See table 42 for population estimates by gender). The exact H-statistics and p-values are provided in tables 35, 36, and 37

Age   The observed delivery of none of the non-control images (N=520, p < 0.05) and none of the control images (N=130, p < 0.05) matches Facebook's population estimates (See table 43 for population estimates by age). The exact H-statistics and p-values are provided in tables 38, 39, and 40

6. Discussion

We show experimentally that within gender, age, and location based ad destinations, climate ads featuring different content are delivered differently. This suggests that climate advertising is vulnerable to algorithmic decision-making. Further, ad content consistently influences ad delivery, with nearly 90% of ad pairs featuring the same image having statistically similar delivery. Further, delivery decisions made by Facebook's Algorithmic Decision System (ADS) are not proportional to Facebook's ad audience estimates for gender, age, and U.S. state based ad destinations and could misguide advertisers, suggesting that delivery skew is a feature built into the algorithmic system. While, we do not verify this in our experiment, we note that past research has determined that delivery decisions are largely driven by automated classifications considered by the ADS and not due to interactions of the ad audiences with the ad. Startlingly, ads that appear invisible to a human (but visible to an automatic image classifier system) are delivered similarly to ads that are fully visible to humans, by Facebook (32).

Our ad experiments control for the spend made on an ad by setting a budget of $1 on each ad. Our results indicating preferential delivery, therefore, also indicate preferential pricing. It is 'cheaper' to advertise images of oil rigs to males and older audiences and images of solar cells to females and younger audiences. Advocacy advertising is decentralized among 482 advertisers associated with 45 advocacy organizations. These organizations are also cash strapped, with 15% of advocacy ads requesting for donations or subscriptions. Preferential pricing could therefore adversely impact the advertising strategy employed by advocacy organizations. Ad budget has also been shown to have an impact on algorithmic decision making (32), with lower budget ads being preferentially delivered to men. Based on our pilot experiments, where the ad budget was set to $5 instead of $1, we speculate that increasing the ad budget may further increase the divide between the delivery ratio of contrarian and advocacy ads. However, the role of ad budgets on ad delivery is difficult to test experimentally given the number of logistical constraints on the platform side, and the budgetary constraints when pursuing audits.

Our results also highlight how advertising algorithms may impact the consumption of climate communications by audiences that have different psychological, cultural, and political reasons for their response to the climate crisis. The Six Americas Report(43) segments the U.S. population into six groups based on their response – Alarmed, Concerned, Cautious, Disengaged, Doubtful and Dismissive. This order is decreasing in the magnitude of their concern towards the climate crisis. Communication studies have noted that these groups require different persuasion strategies, and information channels, for climate engagement (44). For example, audiences in the Doubtful and Dismissive category are best engaged by adopting non-confrontational approaches, and by framing messages in ways that are consistent with their values. Past research has shown that directly challenging the beliefs of these groups is likely to trigger counter argumentation rather than persuasion, suggesting that pro-attitudinal messaging is a better advertising strategy than counter-attitudinal messaging (44). Audiences in these groups are also more likely to be older individuals and male and located in the interior regions of the U.S. (45, 46) – demographics and regions where the algorithm preferentially delivers ads featuring pictures of an oil rig, and likely enables contrarian content as found in the analysis of non-targeted ads in our observational study. Advocacy ads featuring images of oil rigs are more likely to use these images to dissuade audiences from fossil fuels. Algorithms direct these ads at male and older audiences who are more likely to be in segments that are Doubtful or Dismissive about the climate crisis, and may thus feel more alienated from the climate action cause. Similarly, contrarian ads featuring renewable energy sources such as solar cells may sometimes be used to show the advertiser as being sustainable, a practice called greenwashing. Research is divided on whether these ads lead individuals to view actors as being more (47) or less sustainable (48). Therefore the implications of the algorithm's recommendation of ads

featuring solar cells to female and younger audiences (or to the 3 states (California, Kentucky and New York) where solar cell ads were delivered preferentially) is unclear. However, our experiment shows that these audiences may be more vulnerable to greenwashing ads, and therefore need to be inoculated more frequently against the practice.

The Six Americas report also highlights that liberal audiences are more likely to be in the Alarmed or Concerned segment than conservative audiences. Our finding that non-targeted contrarian ads are delivered to states that are likely to vote Republican, and non-targeted advocacy ads are delivered to states likely to vote Democrat is concerning, and suggests that the algorithm may be complicating the process of convincing individuals about the harms of climate change. The Six Americas report provides granular information on the six segments that future work can explore to further understand the racial and political implications of algorithmic bias. Overall, we note that social media platforms are a set of new and constantly evolving actors who play an influential role in the climate discourse ecosystem. It is important for social media and disinformation scholars to not just study the proliferation of information on these platforms but to also account for the delivery patterns of the information on these platforms, in order to engage diverse audiences towards climate action.

7. Consent and Ethics

Our research was conducted with an exemption from MIT COUHES, with application ID E-4191. Ad experiments were run using images of objects that had already been used in ads by both the contrarian and advocacy actor whose logos are featured. Ads were launched in full accordance with Facebook's Ad Review policies. Further, our experiment launched ads featuring only images and no text to abstain from propagating climate disinformation.

8. Acknowledgements

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9. Appendix

9.1 Dataset
The full observational and experimental datasets are available on Dropbox.

9.2 Various Impression Classes on the Ad Archive
0_999, 1000_1999, 2000_2999, 3000_3999, 4000_4999, 5000_5999, 6000_6999, 7000_7999, 8000_8999, 9000_9999, 10000_14999, 15000_19999, 20000_24999, 25000_29999, 30000_34999, 35000_39999, 40000_44999, 45000_49999, 50000_59999, 60000_69999, 70000_79999, 80000_89999, 90000_99999, 100000_124999, 125000_149999, 150000_174999, 175000_199999, 200000_249999, 250000_299999, 300000_349999, 350000_399999, 400000_449999, 450000_499999, 500000_599999, 600000_699999, 700000_799999, 800000_899999, 900000_999999, 1000000_1000000

9.3 Metadata
The metadata that is most relevant to our analysis and work are the following:

- `ad_reached_countries` - Facebook delivered the ads in these countries. We use this attribute to filter advertisements that were only shown in the United States.
- `delivery_by_region` - A state-wise breakdown of the ad delivery percentage.
- `demographic_distribution` - A gender and age wise breakdown of the ad delivery percentage.
- `impressions` - A range representing the minimum/maximum number of non-unique Facebook accounts that were shown an ad. The smallest bin represents ads that were shown to between 0 - 999 Facebook accounts and the largest bin contains ads that were shown to > 1M Facebook accounts.
- `spend` - A range representing the minimum/maximum amount that was spent on an ad. The smallest bin represents ads whose expenditure was between $0 - $100 and the largest bin represents ads whose expenditure was >$1M.

9.4 Ad Attributes
The ad archive associates the following attributes with each ad:

1. A unique identifier for the ad
2. The time that the ad was created
3. The time at which the ad began running
4. The time at which the ad stopped running
5. A unique URL that points to the exact ad
6. The currency used to pay for the ad
7. The estimated size of the Facebook account population from which user accounts were sampled to be shown the ad
8. The budget class for the ad, platforms on which the ad was shown
9. The impressions class[§] for the ad.

[§]An ad impression is a non-unique view that was received by an ad. For example, if an ad was shown to 10 unique Facebook accounts, such that 2 unique accounts were shown the ad 4 times, the total number of impressions received by the ad would be 16 (8 + 2 * 4). Data from the Facebook ad library provides the impressions *class* attribute for each ad, i.e the lower and upper bound of the impressions that would have been received by the ad.

10. Funding information for the ad
11. Delivery information for the ad across multiple demographics

9.5 Methods: Observational Study
We analyze the dataset to provide insights into the destinations reached by climate contrarian and advocacy advertising across various location, gender, and age demographics in the United States. Studying the delivery information for various ads alongside the associated targeting intent would enable accurate disentanglement of the algorithm's role from the advertiser's role in causing delivery. However, as stated previously, the Facebook Ad Library only provides the delivery information associated with each ad. The data itself does suggest certain proxies for targeting, which are used to draw insights about the entanglement between targeting and delivery. If the delivery volumes are significantly different, we further analyze if contrarian or advocacy advertisements dominate in different destinations. To do this:

- For each possible location, gender, or age category, and for each possible category of impression volumes defined above, it is verified if the distribution of advocacy and contrarian ads consists of at least 30 samples.
  - If the distribution contains $>= 30$ samples, it is first verified if the sample distributions are homoscedastic using Levene's Test. A 2 sample Welch's T-test is then used to investigate if the distribution of contrarian ads is significantly different from the distribution of advocacy ads, for each location, gender, and age category. For example, when analysing the difference in delivery volumes for various location destinations, this analysis would be conducted for each U.S. state, and reported at the state level.
  - If the distribution contains < 30 samples, a 2 sample Mann-Whitney U Test is used to investigate if the distribution of contrarian ads is significantly different from the distribution of advocacy ads, for each location, gender, and age category, after establishing the homoscedasticity assumption of the sample distributions using a Levene's test.
- If the delivery volume distributions of contrarian and advocacy ads are found to be significantly different ($p < 0.05$) using the Welch's T-test or the Mann-Whitney U Test, the means or medians of the sample distributions (depending on whether the data was normal or not) are used to further determine if contrarian or advocacy ads dominated in the location, age, or gender category being considered.
- For advertisements delivered to a single location, or gender or age type, normalized advertisement counts are compared for contrarians and advocates.

9.6 Tabular Results: Observational Study

9.6.1 All Ads: Region T values from statistical analyses for all ads in the dataset are presented in Tables 2, 3, 4, 5, and 6.

9.6.2 Targeted Ads: Region Mean delivery percentage values from statistical analyses for targeted ads in the dataset are presented in Tables 7, 8, 9, 10, and 11.

9.6.3 Non-Targeted Ads: Region T values from statistical analyses for non-targeted ads in the dataset are presented in Tables 12, 13, 14, 15, and 16.

9.6.4 All Ads: Gender T values from statistical analyses for all ads in the dataset are presented in Table 17

9.6.5 Targeted Ads: Gender Mean delivery percentages for males and females from targeted contrarian ads in the dataset are presented in Table 18. Note that there were no advocacy ads that were targeted by gender, hence no analyses were conducted for advocacy ads by gender.

9.6.6 Non-Targeted Ads: Gender T values from statistical analyses for non-targeted ads in the dataset are presented in Table 19

9.6.7 All Ads: Age T values from statistical analyses for all ads in the dataset are presented in Table 20

9.6.8 Targeted Ads: Age Mean delivery percentages for different age groups from targeted contrarian ads in the dataset are presented in Table 21. Note that there were no advocacy ads that were targeted by age, hence no analyses were conducted for advocacy ads by age.

9.6.9 Non-Targeted Ads: Age T values from statistical analyses for non-targeted ads in the dataset are presented in Table 22

9.7 Ad Campaign Attributes We briefly describe the attributes that were used for our ad campaigns.

- *Duration* - The 652 ad campaigns were run in 3 batches, such that each batch was run for a period of 24h in order to reach all timezones of the U.S.¶
- *Ad media* We use images of oil rigs, solar cells or controls (Fig. 4). Each image was modified with the logo of a contrarian or advocacy organization, depending on the treatment group it was assigned to.
- *Ad text* For each ad, we included the text, "Use our website to tell us what you think about this picture."
- *Desired audience attributes* - The ads were scheduled to be delivered to anyone in the United States who belonged to the default age criteria on Facebook, irrespective of gender and location. We did not use any additional micro-targeting features.
- *Ad placement* - We specified that the ads could only be shown on the Facebook platform, and could only be situated on a user account's Facebook feed.
- *Ad budget* - We specified a daily ad budget of $1/day.
- *Campaign Objective* - We specified that the ads' objective was to maximize audience traffic to the website. This website collected opinions about the ad images, when shared by a visitor. It did not contain content that revealed the intentions of our experiment, or a stance on climate action or climate change.
- *Ad type* - We ran the ads under the 'Social issues, elections or political issues' category, in accordance with Facebook's advertising guidelines.

¶ The 652 ads were run in 3 batches since Facebook has an upper limit of 250 concurrent ads that can be run by an advertiser whose advertising budget is less than $1,000,000/month. Batch 1 (22 ads per campaign) was run from X to Y on Z. Batch 2 (22 ads per campaign) was run from X to Y on Z. Batch 3 (21 ads per campaign) was run from X to Y on Z. Since the ads are run simultaneously and run for a time period that spans all the timezones in the U.S, we minimize any market effects to the extent possible.

9.8 Experiment: Sampling control images To sample control images, we utilize the ImageNet-21k dataset (42) and the WordNet (49) hierarchy. The ImageNet-21k dataset contains images grouped under 21,841 classes; WordNet is a large lexical database of English. In WordNet, nouns, verbs, adjectives and adverbs are grouped into sets of cognitive synonyms (synsets)(49), each expressing a distinct concept. The 21,841 labels in the ImageNet-21k dataset are a direct mapping to the noun synsets in Wordnet. We devise a methodology to randomly sample diverse ImageNet categories, such that a sampled category contains at least one image of width and height greater than 600px, which is a criteria required by Facebook's Ad Platform.

ImageNet Labels Tree We begin by constructing the WordNet tree for all the labels (synsets) in the ImageNet-21K dataset. The root of this tree is the synset, "entity"(49), level 1 of this tree contains nodes that are descendants of the "entity" node, level 2 contains descendants of nodes in level 1 and so on.

We then devise a methodology to randomly sample 300 different terminal nodes of this tree, such that these nodes are not related to each other, and the ImageNet category associated with the node contains images of width and height greater than 600px. We found, empirically, that it was necessary to sample roughly 4x the number of images we needed, in order to gather images that satisfied the Facebook Ad Platform's size criteria. To select 65 control ad images, we therefore sampled 300 categories.

In order to gather diverse images, we started at a tree level that has > 300 nodes. Level 6 of the tree is the highest level to have > 300 nodes at 1188. We begin by sampling a random category on level 6 of the WordNet tree. For each category sampled on level 6, we sample a random sub category on the subsequent level, repeating this process until we sample a category that has no descendants. We repeat this process 300 times, to sample 300 unique categories from the 21,841 synsets. From each selected category, we sample a random image having at least 600px width and 600px height to satisfy Facebook criteria for ad images; only 103 categories satisfy this condition. We randomly sample 65 categories from this filtered set to get 65 control images.

We use the *random* library on python for all our sampling needs.

9.9 Additional Analyses: RQ1, Region axis When we exclude the images containing logos from the groups considered above, the Kruskal-Wallis test finds that in 35 states there is a statistically significant difference ($p < 0.05$) between the D^R of ads featuring solar cells, oil fields, and controls. Within each state, we then investigate the pairwise differences between the 3 image groups using a Mann Whitney U Test with a Bonferroni correction, and find that in 17 states, there's a statistically significant difference ($p < 0.05$) between the delivery of images showing solar cells and oil fields. In 24 states, there's a statistically significant difference ($p < 0.05$) between the D^R of solar cell images and the control images and in 11 states there's a statistically significant difference ($p < 0.05$) between the D^R of oil field images and the control images.

When we exclude the control images from our omnibus

test, and directly investigate if there's a difference between the solar cell images and the oil field images in different states in the U.S, we actually see that in 29 states, where there is a significant difference between the D^R of solar cells and oil fields.

9.10 Ad Delivery and Objects in an Ad Image H-statistic and associated p-values from the Kruskal-Wallis test investigating if the population medians of ads featuring solar cells and oil rigs with no logo, logo of an advocacy organization and logo of a contrarian organization are significantly different. Results for U.S. State based ad destinations, gender based ad destinations and age based ad destinations are available in tables

9.11 Ad Delivery and Logos in an Ad Image H-statistic and associated p-values from the Kruskal-Wallis test investigating if the population medians of ads featuring solar cells and oil rigs are significantly different. Results for U.S. State based ad destinations, gender based ad destinations and age based ad destinations are available in tables 26, 27, and 28.

9.12 Ad Delivery Attribution to Ad Image p-values from Fisher's exact test, comparing the delivery of two ads featuring the same image and running at the same time, for U.S. State based ad destinations, gender based ad destinations and age based ad destinations are available in tables 29, 30 and 31

9.13 Ad Delivery vs Facebook's Population Estimates

9.13.1 U.S. States χ^2 statistics and associated p-values for the 3 batches of ads in our experiment show whether observed ad delivery was proportional to Facebook's population estimates. We find that in a majority of cases, the values were not proportional, as shown in tables 32, 33 and 34

9.13.2 Gender χ^2 statistics and associated p-values for the 3 batches of ads in our experiment show whether observed ad delivery was proportional to Facebook's population estimates. We find that in a majority of cases, the values were not proportional, as shown in tables 35, 36 and 37

9.13.3 Age χ^2 statistics and associated p-values for the 3 batches of ads in our experiment show whether observed ad delivery was proportional to Facebook's population estimates. We find that in a majority of cases, the values were not proportional, as shown in tables 38, 39 and 40

U.S. State	t Value	p Value	$N_{\text{contrarians}}$	$N_{\text{advocates}}$
Alabama	13.2836346869786	3.739807955784749e-39	2952	17488
Alaska	17.240934066892773	5.068944745356406e-63	2423	14916
Arizona	16.851408808758244	7.3456807716259915e-62	4230	23737
Arkansas	4.4920164462999645	7.2325244104419225e-06	2780	17127
California	-1.9379163824345829	0.05269482670250833	4007	25750
Colorado	19.86519910871058	1.496703520596214e-84	4466	24025
Connecticut	3.958532532578084	7.73765850425023e-05	2603	22342
Delaware	-4.130710376783742	3.6387373952967525e-05	1655	13585
Florida	-0.27381519121822184	0.7842383078980351	3713	24442
Georgia	22.670300249069744	2.6410871915098973e-107	3982	22357
Hawaii	5.715382775812889	1.3065978832880435e-08	1545	16620
Idaho	2.845113390129835	0.00470729569349185	2397	17071
Illinois	14.39499384548478	4.454123756221408e-46	4408	23719
Indiana	12.063608111634577	7.417981655153143e-33	3325	21856
Iowa	21.99355769898966	4.707840854641914e-101	3758	19525
Kansas	7.208000317551227	7.249104903922327e-13	2783	17724
Kentucky	11.606071088430587	1.7783923980833078e-30	2831	20032
Louisiana	20.983975806264496	3.090354038858177e-92	3429	17592
Maine	4.049838978293708	5.294655590899052e-05	2147	19397
Maryland	-11.917195025291829	1.7536809459854717e-32	3383	24048
Massachusetts	-12.419437694187376	1.3769144577971936e-34	2470	23791
Michigan	34.65105539518097	1.936766354955527e-239	5078	25326
Minnesota	21.348390950419184	5.312483813933351e-96	3923	22780
Mississippi	26.256774733444303	3.128689679395918e-146	2585	12234
Missouri	7.454455303695986	1.1741580879687504e-13	2766	21516
Montana	7.304416746630129	3.6796751553835977e-13	2430	16920
Nebraska	7.733540131461022	1.4784749741935765e-14	2562	16169
Nevada	7.442202787790679	1.209926168634202e-13	3323	20625
New Hampshire	12.993405395151294	2.3878751602799994e-37	2311	19094
New Jersey	21.415813939310823	6.851424203910463e-97	4080	24040
New Mexico	44.98366210107125	0.0	4913	20577
New York	31.580055975703036	4.724394287119731e-200	4890	25149
North Carolina	8.697531833691837	4.724050669214264e-18	3754	23712
North Dakota	9.489782521864196	5.6271369304580964e-21	2219	8652
Ohio	20.964732710971113	2.62963386256892e-93	4317	24056
Oklahoma	18.997405316789884	3.3383941500622e-76	3075	18306
Oregon	-1.0075955583566059	0.3137279064344381	2804	22936
Pennsylvania	27.364666376450877	1.4531522160208e-155	5313	25361
Rhode Island	-3.1957822455215212	0.0014205380001538139	1372	16636
South Carolina	6.090484617248452	1.239274772509824e-09	3210	20719
South Dakota	0.39445110246690346	0.6932751872064393	2043	11202
Tennessee	9.585056932778427	1.8159809842006805e-21	2888	21587
Texas	61.54170225760835	0.0	6155	23694
Unknown	2.7289047247655227	0.008813513611322706	48	587
Utah	13.062611692363397	4.732246995975036e-38	3224	19217
Vermont	3.4709020442412375	0.0005362680410615062	1251	16964
Virginia	20.016768412757628	9.245854973881884e-86	4517	24364
Washington	-0.8030176584996715	0.42202117980345666	3070	23420
"Washington D.C"	13.413337421194301	3.4578387084297373e-38	1109	14873
West Virginia	9.614198448735687	1.3995970063944841e-21	2889	16105
Wisconsin	7.933730250091047	2.7270833204275353e-15	3661	23086
Wyoming	2.8180785428073376	0.004862582488173859	2196	11037

Table 2. Observational Study, All Ads: t Values and associated p values for each state destination for ads receiving < 1000 impressions.

U.S. State	t Value	p Value	$N_{contrarians}$	$N_{advocates}$
Alabama	16.149688886981693	3.2869252201135587e-57	4898	25557
Alaska	20.244076369200148	8.787456224905471e-88	4992	25946
Arizona	7.653594202514507	2.193838227984813e-14	6165	28543
Arkansas	8.590132248046663	1.097462654713791e-17	4704	26187
California	4.054436799000379	5.073221406324565e-05	6717	29802
Colorado	18.576033047586158	1.911575665052344e-75	6814	27954
Connecticut	-1.7339992448694264	0.08297898521951685	4551	27126
Delaware	-2.600148082980233	0.009336330337985315	4055	26108
Florida	-6.149298929856927	8.121049950579821e-10	5617	28640
Georgia	16.60984917969212	1.0994586212805922e-60	5705	27251
Hawaii	6.155812746898968	8.145062533804434e-10	4122	25101
Idaho	4.495953846805238	7.078318190664417e-06	4491	26189
Illinois	5.381941702448641	7.56720101665709e-08	6379	27862
Indiana	7.746486216786919	1.0959493875215687e-14	5182	27465
Iowa	21.004533343045175	1.3217204616072137e-94	5847	26687
Kansas	9.269305150420037	2.7159098934161735e-20	4784	25310
Kentucky	13.15533355180603	6.99263479789722e-39	4746	26558
Louisiana	25.08653177960083	7.421795417300007e-132	5504	25797
Maine	3.661850501572537	0.00025298924163335825	4291	26792
Maryland	-10.35125918810862	5.212853188464006e-25	5585	28625
Massachusetts	-37.4768862413715	3.61178008270979e-290	4406	27594
Michigan	30.775427442498014	7.073829308823282e-197	6925	29081
Minnesota	18.60646512303843	2.2774214057717536e-75	6016	27420
Mississippi	14.51344653502438	8.293321886040176e-47	4438	24267
Missouri	8.785089852701702	2.119170414858467e-18	4725	26654
Montana	14.386579905562783	5.306784089255233e-46	4698	26145
Nebraska	8.701732596015384	4.365978721046872e-18	4619	26169
Nevada	4.035028720485814	5.517831670114826e-05	5377	27702
New Hampshire	4.718435153034332	2.4407687731754956e-06	4435	26825
New Jersey	18.271634870503966	8.622296106731824e-73	5969	28086
New Mexico	42.70820985169144	0.0	7280	27396
New York	21.200940821049713	7.284088851315487e-97	6707	29031
North Carolina	1.1731421178342474	0.24077494094932572	5572	28208
North Dakota	12.928817823645947	1.3133267858463132e-37	4719	22881
Ohio	22.439791114429024	4.990330869985559e-108	6652	28496
Oklahoma	25.551780272307095	5.194898099809961e-136	5341	26263
Oregon	-0.7267923222073516	0.46738417985539504	4745	27129
Pennsylvania	27.72268606417865	1.1757790148510029e-162	7816	29818
Rhode Island	-9.713091211384318	3.405036987731496e-22	3769	26147
South Carolina	4.064829522557466	4.862010032050593e-05	5025	27072
South Dakota	2.2293326339516852	0.025830812440318044	4326	24313
Tennessee	8.920260930129444	6.105287583342674e-19	4772	26799
Texas	71.48098885235689	0.0	8995	27726
Unknown	0.04088734681345824	0.9674006545684993	424	1991
Utah	10.126234889487872	6.635565940345388e-24	5456	26388
Vermont	0.9144340958026438	0.36054707977701894	3665	25905
Virginia	19.25697566162191	8.836864244567227e-81	6683	28796
Washington	0.8576518713021785	0.39111880272239696	5092	27658
"Washington D.C"	14.607250788978652	6.677014189155202e-47	3199	26227
West Virginia	11.795464720595543	9.865845126036863e-32	5075	26436
Wisconsin	3.6012379788107602	0.0003187696615820634	5825	28289
Wyoming	4.990030497321931	6.231377473416675e-07	4459	24712

Table 3. Observational Study, All Ads:: t Values and associated p values for each state destination for ads receiving 1K - 10K impressions.

U.S. State	t Value	p Value	$N_{\text{contrarians}}$	$N_{\text{advocates}}$
Alabama	13.631356101805594	2.347104423550024e-41	3740	15752
Alaska	18.125965860626245	7.627383569721037e-71	4064	16171
Arizona	-2.2439924895066565	0.024862845327724682	4476	17576
Arkansas	9.460396888257277	4.772452906054855e-21	3656	16082
California	3.1536715238791686	0.001620360076553684	4819	18148
Colorado	17.687716562334458	2.5111479870299496e-68	5085	17078
Connecticut	-2.35916908380124	0.01835959494765869	3549	16612
Delaware	-1.466848694327391	0.14247622305806634	3318	16304
Florida	-6.837160264891821	8.70170413919228e-12	4167	17600
Georgia	8.404830349739541	5.447661748688815e-17	4184	16703
Hawaii	-5.725361715113461	1.0750422300198268e-08	3451	15473
Idaho	3.794077605724721	0.00015025105962616133	3569	16051
Illinois	0.9724672392972499	0.33085258981625254	4572	16923
Indiana	4.845530183104017	1.2961927871413994e-06	3963	16685
Iowa	12.678692973156117	2.967867622514428e-36	4300	16292
Kansas	5.983699612591824	2.3576380221287402e-09	3748	15826
Kentucky	11.371168517782342	1.6970396481244085e-29	3720	16197
Louisiana	20.564911151851966	9.604923408000596e-90	4181	15694
Maine	-8.414299839631543	4.695885446651765e-17	3521	16634
Maryland	2.026565640923631	0.04274464945603675	4358	17501
Massachusetts	-25.61692702686335	2.2315879706327203e-139	3414	16860
Michigan	20.721516200042863	4.879351445330974e-92	4779	17313
Minnesota	11.233841448634504	6.058683502385879e-29	4400	16567
Mississippi	10.831170093571455	6.137844004518437e-27	3439	15544
Missouri	7.746871067614557	1.183328003547734e-14	3680	16226
Montana	11.032656484205857	7.015171566163601e-28	3636	16089
Nebraska	6.574681043569501	5.423245906373616e-11	3671	16185
Nevada	-1.5939969766087276	0.11098556000988635	4030	16967
New Hampshire	-2.9456318934672683	0.003235623781060106	3627	16528
New Jersey	7.594394629313596	3.676405255684259e-14	4141	17331
New Mexico	22.669983558065336	7.969096060609759e-109	4810	16703
New York	0.7448309449073279	0.4564040876483383	4508	17958
North Carolina	-1.7064360634267732	0.08797342973777168	4144	17583
North Dakota	10.105363775563765	1.058206394672463e-23	3659	15764
Ohio	13.368163616680281	3.4952384390199303e-40	4826	17308
Oklahoma	17.084438238351545	3.4148320750226235e-63	3897	16052
Oregon	-2.3166893227447902	0.020566058194915363	3561	16490
Pennsylvania	17.25993091796247	2.3924788886143453e-65	5361	18223
Rhode Island	0.6932312586670308	0.4882095185806071	3175	15959
South Carolina	6.009943267423379	1.995957097621088e-09	3730	16387
South Dakota	0.9527867494104734	0.34072730215140135	3507	15881
Tennessee	7.9115531779479005	3.161815221071632e-15	3640	16306
Texas	51.86502834814845	0.0	6248	17088
Unknown	-0.6613071951623989	0.5085408953948185	728	3280
Utah	4.75160808438108	2.0757213845859587e-06	4116	16176
Vermont	4.7445129415786225	2.1779718975851034e-06	3289	16009
Virginia	9.231047063730815	3.507172055954565e-20	4848	17862
Washington	1.2269044186653522	0.2199176790555705	3829	16991
"Washington D.C"	13.535525638276855	6.022773451715696e-41	3898	16527
West Virginia	11.209289598348727	9.117029194665707e-29	4017	16634
Wisconsin	-5.876640593423992	4.358033605381851e-09	4250	17246
Wyoming	4.936356668187095	8.289427533577942e-07	3527	15979

Table 4. Observational Study, All Ads: t Values and associated p values for each state destination for ads receiving 10K - 100K impressions.

U.S. State	t Value	p Value	$N_{\text{contrarians}}$	$N_{\text{advocates}}$
Alabama	8.178159375268372	5.585897941052643e-16	1544	4164
Alaska	10.662073608617675	9.514027133296105e-26	1646	4246
Arizona	-6.846803505249799	8.455106947322627e-12	1796	4711
Arkansas	7.684197652096507	2.6285203870840744e-14	1553	4269
California	-7.984971760742617	2.0719962022089683e-15	1803	4683
Colorado	12.61434735726191	2.2639615207653574e-35	1964	4443
Connecticut	-3.4002155243892975	0.0006833492969778226	1543	4379
Delaware	-4.137125191220135	3.581936098025576e-05	1454	4322
Florida	-7.332667594822226	2.624922910538294e-13	1685	4560
Georgia	0.4136626232003551	0.6791460342494102	1754	4434
Hawaii	-7.33226198286745	2.708593759277865e-13	1474	4119
Idaho	2.771922981530959	0.005626699485388683	1501	4253
Illinois	-4.644605094208206	3.4949493144685174e-06	1839	4507
Indiana	6.09156457472451	1.3392162241363458e-09	1654	4433
Iowa	4.454029923174862	8.710025960138764e-06	1764	4344
Kansas	2.2584432300218737	0.024004180846231616	1571	4269
Kentucky	7.965561353816127	3.1082160613385484e-15	1544	4300
Louisiana	9.802881841449167	3.8251484908948866e-22	1677	4165
Maine	-12.025335026444514	6.314766020385051e-33	1497	4481
Maryland	3.924747179739483	8.882801365746853e-05	1831	4596
Massachusetts	-10.993528838400124	1.0812281523293315e-27	1437	4421
Michigan	11.460233884567927	1.1485967303881125e-29	1939	4541
Minnesota	5.772096188237374	8.94683676899346e-09	1757	4372
Mississippi	8.098637325794083	1.1117213097765713e-15	1428	4116
Missouri	4.28054677807948	1.9015024476585496e-05	1512	4334
Montana	2.6986481554656407	0.007028113409342215	1454	4264
Nebraska	6.049715262500332	1.76139340247934e-09	1602	4285
Nevada	-6.822733024080752	9.991222521057193e-12	1609	4510
New Hampshire	-7.320783246908578	2.8924471918237003e-13	1560	4353
New Jersey	-5.414723025935078	6.520642098856539e-08	1598	4652
New Mexico	3.270921037748254	0.001086039376360667	1735	4372
New York	-5.969681182026049	2.6380663785521785e-09	1761	4689
North Carolina	-7.195307054215077	7.100381944409116e-13	1744	4605
North Dakota	4.3998686208830415	1.1588942060648206e-05	1515	4221
Ohio	0.6399532859710809	0.5222408592173955	1908	4584
Oklahoma	10.969885464503816	3.459855451511159e-27	1538	4240
Oregon	-2.2735021284730297	0.023090457927618865	1445	4355
Pennsylvania	2.689278341397946	0.007196650336479526	1986	4771
Rhode Island	-1.073890292273605	0.28302572447155006	1382	4241
South Carolina	2.967803824387606	0.0030236435888136137	1588	4349
South Dakota	2.2692986499606667	0.023366382247766233	1544	4237
Tennessee	6.192443898665367	7.158735116442888e-10	1492	4316
Texas	23.18817070173268	2.610728563212818e-108	2282	4506
Unknown	-1.0937207447986308	0.27433014632975455	508	1824
Utah	-0.5818940502971953	0.5606613949637904	1715	4296
Vermont	-8.188156212139758	3.45761066574526e-16	1418	4251
Virginia	2.275362140662805	0.022935807308392488	1977	4634
Washington	-2.534124868967354	0.011331949879040492	1516	4466
"Washington D.C"	6.831313033253349	1.0712162133310315e-11	1721	4394
West Virginia	4.23216766716242	2.4033821702152354e-05	1602	4399
Wisconsin	-3.794772634565084	0.00014973008666329776	1781	4551
Wyoming	3.4287268921290113	0.0006231357245072427	1464	4236

Table 5. Observational Study, All Ads: t Values and associated p values for each state destination for ads receiving 100K - 1M impressions.

U.S. State	t Value	p Value	$N_{\text{contrarians}}$	$N_{\text{advocates}}$
Alabama	3.3313525467526834	0.00098231397505672	271	277
Alaska	-0.01986037893413233	0.9841624410937129	252	272
Arizona	-3.7628159404199204	0.00019621104167365276	275	299
Arkansas	11.504004748737968	4.418094663022708e-27	265	278
California	-10.159202442023634	3.0941416832997245e-22	283	296
Colorado	3.4419886079299213	0.0006425979913303564	291	285
Connecticut	-13.56397839515139	4.6737615575806076e-36	262	287
Delaware	-1.153604210500254	0.24963226361891777	245	281
Florida	-3.606307552630564	0.0003603632593528498	284	289
Georgia	-0.09893428588040762	0.9212253205862836	286	288
Hawaii	-1.681698997173907	0.09376815510277939	249	274
Idaho	4.261027530455748	2.4151469146052674e-05	256	279
Illinois	-2.976888049627756	0.0030773933689166753	298	297
Indiana	4.3182750111856505	1.9976096465999054e-05	285	280
Iowa	-1.1539632775839455	0.24947477219260983	283	280
Kansas	6.999147132209057	8.477758852166628e-12	263	281
Kentucky	9.208477511339854	1.2831439118332953e-18	264	277
Louisiana	3.5548985795003207	0.00044382292762170977	279	277
Maine	-4.94338974684759	1.2855821140123266e-06	241	298
Maryland	1.0632457413910694	0.28835097572986434	282	286
Massachusetts	-15.501734435421405	8.795018294743957e-45	256	282
Michigan	3.510324227212844	0.0004948795928005521	306	285
Minnesota	3.4526307702239714	0.0006229416963296553	286	280
Mississippi	12.777592742287899	1.7759231408944572e-31	251	272
Missouri	5.03199576368807	6.903000053756088e-07	260	281
Montana	2.0865225773946485	0.03742500629149018	244	276
Nebraska	5.831041360551398	9.741407784279942e-09	263	278
Nevada	-4.519308126753277	8.943894538062632e-06	260	300
New Hampshire	-1.7116326940465247	0.08806735358228573	254	281
New Jersey	-3.972638515067024	8.791266144184594e-05	265	300
New Mexico	0.9955862238389904	0.32035323360600326	266	281
New York	-4.5239008854753715	7.558464385812173e-06	284	295
North Carolina	-1.931376138311832	0.05437413747598708	283	288
North Dakota	3.0278719441080444	0.0027149861028227767	256	274
Ohio	-0.8262411745721226	0.4092369785322494	294	287
Oklahoma	9.663232519430869	9.357404031508628e-20	266	275
Oregon	-1.7728814509101967	0.07685119808916557	244	282
Pennsylvania	-2.8932950743384596	0.0040185730035288865	287	304
Rhode Island	-16.422150136764106	5.929095043439078e-49	244	276
South Carolina	7.54797388806294	3.699817715577841e-13	268	279
South Dakota	8.119316846499041	4.1495193266806056e-15	261	277
Tennessee	2.5763072989563227	0.01050863390650978	266	281
Texas	6.309156861824312	7.351861022508533e-10	323	283
Unknown	-2.5894191898944827	0.010202777196283357	129	207
Utah	-2.3513793912054437	0.019055110311840175	268	289
Vermont	-10.35774103887577	6.360157566313322e-23	241	277
Virginia	0.21711586534656563	0.8281961098838814	296	288
Washington	0.38239178355995945	0.7023730143128443	258	281
"Washington D.C"	1.6028754440806876	0.10971383217849577	261	279
West Virginia	9.85138323632489	9.36365146448937e-21	262	279
Wisconsin	3.460998364527403	0.0006067796349462026	292	283
Wyoming	4.3234426192398265	1.908796574442362e-05	241	275

Table 6. Observational Study, All Ads: t Values and associated p values for each state destination for ads receiving 1M+ impressions.

U.S. State	Mean Delivery Percentage (Contrarians)	Mean Delivery Percentage (Advocates)	$N_{\text{contrarians}}$	$N_{\text{advocates}}$
Alabama	0.0010833935218623257	0.0	39	0
Alaska	0.007722651258403245	0.002880097013794149	278	133
Arizona	0.009944996944274682	0.009831308603477772	358	454
Arkansas	0.0	0.0023820351241906493	0	110
California	0.013528529362742375	0.025682669611728274	487	1186
Colorado	0.018862159008833822	0.018146776673379675	679	838
Connecticut	0.0014167453747430414	0.0007795751315533034	51	36
Delaware	0.0	0.0002165486476536954	0	10
Florida	0.003027945996999833	0.013036228588752464	109	602
Georgia	0.010917273181843436	0.003161610255743953	393	146
Hawaii	0.0011945108061558977	0.0011043981030338466	43	51
Idaho	0.00011111728429357187	0.0010039433508737738	4	48
Illinois	0.010778376576476472	0.018125121808614305	388	837
Indiana	0.0029723873548530475	0.0017107343164641936	107	79
Iowa	0.009167175954219679	0.0013859113449836507	330	64
Kansas	0.0006944830268348242	0.00012992918859221724	25	6
Kentucky	0.00013889660536696484	0.0001082743238268477	5	5
Louisiana	0.002694594144119118	0.0008445397258494121	97	39
Maine	0.0016667592644035779	0.003443123497693757	60	159
Maryland	0.00013889660536696484	0.013447671019294484	5	621
Massachusetts	0.00041668981610089447	0.0029017518785595183	15	134
Michigan	0.04397466525918107	0.04437081790424219	1583	2049
Minnesota	0.01125062503472415	0.0076225123974100785	405	352
Mississippi	0.0	0.00017323891812295633	0	8
Missouri	0.0	0.00028151324194980405	0	13
Montana	0.0021667870437246514	0.0029234067433224888	78	135
Nebraska	0.0010000555586421468	0.0004764070248381299	36	22
Nevada	0.004472470692816268	0.01641438749215011	161	758
New Hampshire	0.005028057114284127	0.0036596721453474525	181	169
New Jersey	0.01441746763709095	0.013924078044132614	519	643
New Mexico	0.037613200733374076	0.010026202386366097	1354	463
New York	0.028529362742374578	0.009900842374239373	1027	416
North Carolina	0.006055891993999666	0.013469325884059854	218	622
North Dakota	0.0017778765486971498	0.00028151324194980405	64	13
Ohio	0.01208400466692594	0.008856839689036142	435	409
Oklahoma	0.0036668703816878714	0.00023820351241906495	132	11
Oregon	0.0009444969164953609	0.002728512960436562	34	126
Pennsylvania	0.021417856547585976	0.024643236102990535	771	1138
Rhode Island	0.0	0.0008445397258494121	0	39
South Carolina	0.0025834768598255457	0.005933432945711254	93	274
South Dakota	0.0001666759264403578	0.0010610883735031075	6	49
Tennessee	0.0002500138896605367	0.000519716754368869	9	24
Texas	0.042113450747263734	0.005132202949392581	1516	237
Utah	0.004333574087449303	0.0009095043201455207	156	42
Vermont	0.00041668981610089447	0.0002598583771844345	15	12
Virginia	0.009694983054614146	0.008077264557482838	349	373
Washington	0.0014445246958164342	0.0036380172805820826	52	168
Washington D.C	0.0018889938329907218	0.0019705926936486283	68	91
West Virginia	0.0006389243846880382	0.0005413716191342385	23	25
Wisconsin	0.0015834213011833399	0.006648043482968449	57	307
Wyoming	0.0001666759264403578	0.001277637021156803	6	59

Table 7. Observational Study, Targeted Ads: Mean delivery percentages in each state destination for ads receiving < 1K impressions.

U.S. State	Mean Delivery Percentage (Contrarians)	Mean Delivery Percentage (Advocates)	$N_{\text{contrarians}}$	$N_{\text{advocates}}$
Alabama	0.0012500694483026835	8.661945906147817e-05	45	4
Alaska	0.011917328740485582	0.004634141059789081	429	214
Arizona	0.005944774709706095	0.015634812360596807	214	722
Arkansas	0.00019445524751375077	0.0020355572879444737	7	94
California	0.02497360964498028	0.036618376318239894	899	1691
Colorado	0.022612367353741874	0.021113493146235302	814	975
Connecticut	0.0008333796322017889	0.0011693626973299552	30	54
Delaware	8.33379632201789e-05	0.0008445397258494121	3	39
Florida	0.0038057669870548362	0.021373351523419737	137	987
Georgia	0.009028279348852714	0.007189415102102688	325	332
Hawaii	0.0011945108061558977	0.0014725308040451288	43	68
Idaho	0.00022223456858714373	0.0009744689144416293	8	45
Illinois	0.007555975331962887	0.020117369367028303	272	929
Indiana	0.0012500694483026835	0.0037896013339396694	45	175
Iowa	0.004528029334963053	0.002403689988956019	163	111
Kansas	0.0013056280904494694	0.0007146105372571949	47	33
Kentucky	0.00027779321073339297	0.00034647783624591267	10	16
Louisiana	0.006750375020834491	0.0022521059355984324	243	104
Maine	0.003166842602366798	0.0064098399705493836	114	296
Maryland	0.0002500138896605367	0.01132549427228827	9	523
Massachusetts	0.00011111728429357187	0.0023387253946599105	4	108
Michigan	0.042113450747263734	0.03720305766690487	1516	1718
Minnesota	0.007889327184843602	0.008337122934667273	284	385
Mississippi	2.7779321073392966e-05	0.0004330972953073908	1	20
Missouri	0.00047224845824768045	0.0004980618896034994	17	23
Montana	0.006917050947274849	0.0032915394443361703	249	152
Nebraska	0.0017778765486971498	0.002165486476536954	64	100
Nevada	0.0030835046391466192	0.015743086684423657	111	727
New Hampshire	0.0015556419801100061	0.004114424305420213	56	190
New Jersey	0.009056058669926106	0.008813529959505403	326	407
New Mexico	0.042280126673704094	0.01641438749215011	1522	758
New York	0.021390077226512583	0.012992918859221724	770	600
North Carolina	0.005416967609311628	0.020918599363346977	195	966
North Dakota	0.0036390910606144784	0.0004114424305420213	131	19
Ohio	0.017889882771265072	0.0143571753394440005	644	663
Oklahoma	0.0090838379909995	0.0005413716191342385	327	25
Oregon	0.001694538585476971	0.0043742826826046475	61	202
Pennsylvania	0.02941830101672315	0.028411182572164836	1059	1312
Rhode Island	5.555864214678593e-05	0.0011260529677992162	2	52
South Carolina	0.0023612422912384023	0.007730786721236926	85	357
South Dakota	0.00041668981610089447	0.0012343272916260637	15	57
Tennessee	0.00041668981610089447	0.0015158405335758678	15	70
Texas	0.06328129340518918	0.006842937265856774	2278	316
Utah	0.0035835324184676927	0.002446999718486758	129	113
Vermont	0.00041668981610089447	0.0002598583771844345	15	12
Virginia	0.01133396299794433	0.012538166699148964	408	579
Washington	0.005361408967164843	0.01126052967799216	193	520
Washington D.C	0.003972442913495194	0.004049459711124104	143	187
West Virginia	0.0011389521640091116	0.001277637021156803	41	59
Wisconsin	0.0011667314850825046	0.012343272916260637	42	570
Wyoming	0.0007222623479082171	0.00140756620974902	26	65

Table 8. Observational Study, Targeted Ads: Mean delivery percentages in each state destination for ads receiving 1K - 10K impressions.

U.S. State	Mean Delivery Percentage (Contrarians)	Mean Delivery Percentage (Advocates)	$N_{contrarians}$	$N_{advocates}$
Alabama	0.0003055725318073226	0.0002165486476536954	11	10
Alaska	0.010056114228568254	0.003421468632928387	362	158
Arizona	0.002694594144119118	0.012148379133372312	97	561
Arkansas	0.00013889660536696484	0.0006496459429610862	5	30
California	0.015778654369687204	0.020420537473743477	568	943
Colorado	0.01713984110228346	0.011931830485718617	617	551
Connecticut	0.0006944830268348242	0.001039433508737738	25	48
Delaware	0.00013889660536696484	0.0005413716191342385	5	25
Florida	0.0023612422912384023	0.014920201823339613	85	689
Georgia	0.0028334907494860827	0.004309318088308539	102	199
Hawaii	0.00019445524751375077	0.00140756620974902	7	65
Idaho	5.555864214678593e-05	0.0003897875657766517	2	18
Illinois	0.0021390077226512583	0.006496459429610862	77	300
Indiana	0.0002777932107339297	0.002035557287944737	10	94
Iowa	0.0013334074115228624	0.0014941856688104982	48	69
Kansas	0.0005278071003944663	0.0006063362134303471	19	28
Kentucky	0.0012222901272292905	0.0003248229714805431	44	15
Louisiana	0.004611367298183232	0.0008878494553801511	166	41
Maine	0.0010556142007889326	0.006886246995387514	38	318
Maryland	0.0003333518528807156	0.004829034842677407	12	223
Massachusetts	0.0001666759264403578	0.001320946750687542	6	61
Michigan	0.018806600366687038	0.01509344074146257	677	697
Minnesota	0.003055725318073226	0.0037679464691743	110	174
Mississippi	0.00011111728429357187	0.00030316810671517357	4	14
Missouri	0.0002500138896605367	0.00034647783624591267	9	16
Montana	0.0038891049502750154	0.0011260529677992162	140	52
Nebraska	0.0005278071003944663	0.0015808051278719765	19	73
Nevada	0.0014445246958164342	0.008163884016544316	52	377
New Hampshire	0.0001666759264403578	0.002273760800363802	6	105
New Jersey	0.003472415134174121	0.004006149981593365	125	185
New Mexico	0.01600088893827435	0.008163884016544316	576	377
New York	0.005028057114284127	0.008120574287013578	181	375
North Carolina	0.0038613256292016223	0.015008051278719766	139	730
North Dakota	0.00225012500694483	0.00019489378288832586	81	9
Ohio	0.006861492305128063	0.0080556096927217468	247	372
Oklahoma	0.00327795988666037	0.00034647783624591267	118	16
Oregon	0.0008333796322017889	0.0019705926936486283	30	91
Pennsylvania	0.013834101894549698	0.012559821563914334	498	580
Rhode Island	0.00044446913717428746	0.0004114424305420213	16	19
South Carolina	0.0012500694483026835	0.002403689988956019	45	111
South Dakota	5.555864214678593e-05	0.0003897875657766517	2	18
Tennessee	0.00041668981610089447	0.0009528140496762598	15	44
Texas	0.03433524084671371	0.0051971675436886895	1236	240
Utah	0.0009444969164953609	0.0012992918859221724	34	60
Vermont	0.0005555864214678594	0.00012992918859221724	20	6
Virginia	0.003222401244513584	0.007860715909829143	116	363
Washington	0.0049169389299990555	0.0097879988873947032	177	452
Washington D.C	0.00402800155564198	0.0036596721453474525	145	169
West Virginia	0.0013056280904494694	0.0007795751315533034	47	36
Wisconsin	0.00041668981610089447	0.00705948591351047	15	326
Wyoming	0.0005278071003944663	0.0003681327010112822	19	17

Table 9. Observational Study, Targeted Ads: Mean delivery percentages in each state destination for ads receiving 10K - 100K impressions.

U.S. State	Mean Delivery Percentage (Contrarians)	Mean Delivery Percentage (Advocates)	$N_{contrarians}$	$N_{advocates}$
Alabama	0.0	0.0001082743238268477	0	5
Alaska	0.003305739207733763	0.00034647783624591267	119	16
Arizona	0.0005555864214678594	0.0037029818748781913	20	171
Arkansas	2.7779321073392966e-05	2.1654864765369542e-05	1	1
California	0.0022223456858714375	0.0029923406743324888	80	135
Colorado	0.004083560197788766	0.002273760800363802	147	105
Connecticut	0.00013889660536696484	0.00015158405335758679	5	7
Delaware	0.0	0.00017323891812295633	0	8
Florida	0.0002777932107339297	0.0027501678252019315	10	127
Georgia	0.00022223456858714373	0.0011260529677992162	8	52
Hawaii	0.0	0.00028151324194980405	0	13
Idaho	0.0	2.1654864765369542e-05	0	1
Illinois	0.00013889660536696484	0.001364256480218281	5	63
Indiana	0.00011111728429357187	0.00012992918859221724	4	6
Iowa	2.7779321073392966e-05	0.00028151324194980405	1	13
Kansas	8.33379632201789e-05	4.3309729530739084e-05	3	2
Kentucky	0.0008333796322017889	2.1654864765369542e-05	30	1
Louisiana	0.0007500416689816101	0.00017323891812295633	27	8
Maine	0.00013889660536696484	0.0029017518785595183	5	134
Maryland	2.7779321073392966e-05	0.00023820351241906495	1	11
Massachusetts	5.555864214678593e-05	0.0003897875657766517	2	18
Michigan	0.006250347241513418	0.0028367872842634096	225	131
Minnesota	0.0005000277793210734	0.0004114424305420213	18	19
Mississippi	0.0	2.1654864765369542e-05	0	1
Missouri	2.7779321073392966e-05	0.00012992918859221724	1	6
Montana	0.00044446913717428746	0.00028151324194980405	16	13
Nebraska	0.00019445524751375077	0.00012992918859221724	7	6
Nevada	2.7779321073392966e-05	0.002728512960436562	1	126
New Hampshire	0.0	0.0006713008077264557	0	31
New Jersey	0.00019445524751375077	0.0008878494553801511	7	41
New Mexico	0.0013056280904494694	0.001277637021156803	47	59
New York	0.0005555864214678594	0.0010177786439723685	20	47
North Carolina	0.0006389243846880382	0.0037896013339396694	23	175
North Dakota	0.00019445524751375077	0.0	7	0
Ohio	0.0010833935218623257	0.0024903094480174972	39	115
Oklahoma	2.7779321073392966e-05	4.3309729530739084e-05	1	2
Oregon	0.00013889660536696484	0.0005630264838996081	5	26
Pennsylvania	0.0018889938329907218	0.0022954156651291712	68	106
Rhode Island	5.555864214678593e-05	2.1654864765369542e-05	2	1
South Carolina	2.7779321073392966e-05	0.00028151324194980405	1	13
South Dakota	8.33379632201789e-05	4.3309729530739084e-05	3	2
Tennessee	5.555864214678593e-05	0.0001082743238268477	2	5
Texas	0.007528196010889494	0.0011260529677992162	271	52
Utah	0.0	0.00012992918859221724	0	6
Vermont	0.0	4.3309729530739084e-05	0	2
Virginia	0.00022223456858714373	0.0011693626973299552	8	54
Washington	0.0010556142007889326	0.0027501678252019315	38	127
Washington D.C	0.0011945108061558977	0.0006929556724918253	43	32
West Virginia	0.0002777932107339297	0.00030316810671517357	10	14
Wisconsin	8.33379632201789e-05	0.0016024599926373459	3	74
Wyoming	5.555864214678593e-05	0.0	2	0

Table 10. Observational Study, Targeted Ads: Mean delivery percentages in each state destination for ads receiving 100K - 1M impressions.

U.S. State	Mean Delivery Percentage (Contrarians)	Mean Delivery Percentage (Advocates)	$N_{\text{contrarians}}$	$N_{\text{advocates}}$
Alabama	0.0	0.0	0	0
Alaska	2.7779321073392966e-05	0.0	1	0
Arizona	2.7779321073392966e-05	0.00019489378288832586	1	9
Arkansas	0.0	0.0	0	0
California	0.0	4.3309729530739084e-05	0	2
Colorado	0.00038891049502750154	4.3309729530739084e-05	14	2
Connecticut	0.0	0.0	0	0
Delaware	0.0	2.1654864765369542e-05	0	1
Florida	0.0	0.0001082743238268477	0	5
Georgia	0.0	0.00012992918859221724	0	6
Hawaii	0.0	2.1654864765369542e-05	0	1
Idaho	0.0	0.0	0	0
Illinois	0.0	6.496459429610862e-05	0	3
Indiana	0.0	0.0	0	0
Iowa	0.0	4.3309729530739084e-05	0	2
Kansas	0.0	0.0	0	0
Kentucky	0.0	0.0	0	0
Louisiana	0.00011111728429357187	0.0	4	0
Maine	0.0	0.0004114424305420213	0	19
Maryland	0.0	0.0	0	0
Massachusetts	0.0	0.0	0	0
Michigan	0.0003055725318073226	6.496459429610862e-05	11	3
Minnesota	5.555864214678593e-05	2.1654864765369542e-05	2	1
Mississippi	0.0	0.0	0	0
Missouri	0.0	0.0	0	0
Montana	0.0	0.0	0	0
Nebraska	0.0	0.0	0	0
Nevada	0.0	0.00030316810671517357	0	14
New Hampshire	0.0	4.3309729530739084e-05	0	2
New Jersey	0.0	0.00015158405335758679	0	7
New Mexico	0.0	0.0	0	0
New York	2.7779321073392966e-05	2.1654864765369542e-05	1	1
North Carolina	0.0	8.661945906147817e-05	0	4
North Dakota	0.0	0.0	0	0
Ohio	0.0	4.3309729530739084e-05	0	2
Oklahoma	0.0	0.0	0	0
Oregon	0.0	4.3309729530739084e-05	0	2
Pennsylvania	0.0	0.0001082743238268477	0	5
Rhode Island	0.0	0.0	0	0
South Carolina	0.0	0.0	0	0
South Dakota	0.0	0.0	0	0
Tennessee	0.0	0.0	0	0
Texas	0.0003333518528807156	4.3309729530739084e-05	12	2
Utah	0.0	0.0	0	0
Vermont	0.0	0.0	0	0
Virginia	0.0	4.3309729530739084e-05	0	2
Washington	0.00011111728429357187	4.3309729530739084e-05	4	2
Washington D.C	0.0	0.0	0	0
West Virginia	0.0	0.0	0	0
Wisconsin	0.0	0.0	0	0
Wyoming	0.0	0.0	0	0

Table 11. Observational Study, Targeted Ads: Mean delivery percentages in each state destination for ads receiving 1M+ impressions.

U.S. State	t Value	p Value	$N_{contrarians}$	$N_{advocates}$
Alabama	35.03893920911009	2.4353810598518363e-151	577	3647
Alaska	-1.379772159152534	0.16812285685575717	522	3403
Arizona	-3.1424494668971303	0.0017454002486166193	577	3713
Arkansas	29.35027253340735	2.1632833514226475e-121	577	3618
California	-38.81734957638038	2.871806550854955e-190	533	3706
Colorado	-1.8398447349627245	0.06628593470855605	574	3713
Connecticut	-28.28811163695321	1.884255515998055e-123	565	3709
Delaware	-0.39624519509331363	0.6920550424218677	512	3202
Florida	3.255337164757002	0.0011826088823597397	577	3706
Georgia	25.266565753476755	7.680095675483296e-100	577	3708
Hawaii	-10.637192441039888	3.545806537411425e-24	453	3502
Idaho	8.702844595727548	2.3382925472802342e-17	565	3637
Illinois	-15.420294441164554	3.511768310076835e-47	577	3708
Indiana	13.923753285442563	3.9492705234724035e-39	577	3715
Iowa	8.787070845344653	1.0193935505830081e-17	576	3691
Kansas	14.067616133756871	5.941582023174618e-40	577	3635
Kentucky	22.69347660478586	3.018511164346351e-85	577	3699
Louisiana	28.889816182127564	4.675643295004365e-115	573	3632
Maine	-17.3727417449359	9.463143313067169e-58	555	3671
Maryland	-17.58600438275698	2.159584295865516e-59	573	3712
Massachusetts	-51.756500402613774	5.098770445007508e-286	570	3715
Michigan	-6.415088203501787	2.400982916605819e-10	577	3715
Minnesota	-12.221737298873371	1.8347653337038155e-31	577	3706
Mississippi	28.935017984923114	2.161149545087592e-116	575	3166
Missouri	15.700762411127293	8.869229064826245e-48	577	3715
Montana	4.610470889016982	4.77262495606022e-06	564	3581
Nebraska	10.912934379442031	1.109238293382683e-25	569	3585
Nevada	0.5095041681799607	0.6105468377954341	573	3666
New Hampshire	-20.383931088471993	8.195655610635204e-76	534	3644
New Jersey	-19.25958967591695	7.458774844381357e-67	577	3715
New Mexico	-3.024071297864736	0.0025771957291348046	569	3696
New York	-35.70301403220312	1.0235681153832044e-170	574	3715
North Carolina	12.366490594660316	6.05763436668837e-32	577	3709
North Dakota	13.238574364712239	1.9862746845125286e-35	534	2553
Ohio	7.886748425465331	1.1815194708452627e-14	577	3715
Oklahoma	31.207098587809817	2.192406965435637e-130	577	3664
Oregon	-41.95166882834439	7.696474773792071e-232	575	3715
Pennsylvania	0.9133093995087685	0.3614104338567381	575	3714
Rhode Island	-18.499729773614025	2.0247051697769446e-63	476	3534
South Carolina	25.907001148298264	4.4302742828457254e-104	577	3696
South Dakota	6.092488965432748	1.834424182370754e-09	544	2983
Tennessee	28.398366011354163	5.02213359856082e-118	577	3714
Texas	28.848957570133066	1.405708674558672e-115	575	3710
Unknown	267.0	0.5514951158440978	5	92
Utah	1.0035759780386149	0.3159214459855837	572	3696
Vermont	-28.057966694954334	3.7988445133077706e-126	442	3486
Virginia	1.0773502833057598	0.28163611499566765	574	3715
Washington	-39.277582722006045	1.5640920415564094e-206	577	3715
Washington D.C	-11.3772421289278	4.984321582033891e-25	173	2909
West Virginia	21.06984693442553	9.014287817931343e-76	574	3535
Wisconsin	-14.477046598221992	2.2389443714895268e-42	577	3715
Wyoming	12.119122375120119	2.3766401779879122e-30	536	2952

Table 12. Observational Study, Non-Targeted Ads: t Values and associated p values for each state destination for ads receiving < 1000 impressions.

U.S. State	t Value	p Value	$N_{\text{contrarians}}$	$N_{\text{advocates}}$
Alabama	56.40480876947256	0.0	2864	15021
Alaska	-6.702428681923706	2.1131832296872146e-11	2787	14964
Arizona	-6.867574291879497	6.976119308152953e-12	2865	15166
Arkansas	67.60831541962507	0.0	2864	15090
California	-54.290808751783615	0.0	2779	15140
Colorado	-5.341363173639038	9.826906877583027e-08	2855	15148
Connecticut	-83.84132818688015	0.0	2829	15165
Delaware	0.9926960277461823	0.3209324396499288	2790	14838
Florida	8.819911061428314	1.6390426379690411e-18	2865	15130
Georgia	51.61045813131714	0.0	2865	15147
Hawaii	-51.88796136410127	0.0	2690	14809
Idaho	23.644346777169293	1.0843371671901851e-114	2854	15102
Illinois	-32.58214433697382	7.74796792704195e-218	2865	15060
Indiana	37.09306985337411	2.039969617614539e-254	2865	15167
Iowa	20.092236404836875	4.0370531121162155e-85	2863	15161
Kansas	40.928186656792676	1.70688561797027e-300	2863	14749
Kentucky	54.16685480646018	0.0	2862	15157
Louisiana	50.388081038493596	0.0	2791	15112
Maine	-40.57785677588742	0.0	2834	15072
Maryland	-12.139944936182266	3.322492925916354e-33	2864	15167
Massachusetts	-133.7909899640646	0.0	2864	15163
Michigan	1.6069389212556013	0.10816506457220854	2865	15167
Minnesota	-11.478483415177285	6.576540573317022e-30	2865	15142
Mississippi	64.93555864302344	0.0	2831	14538
Missouri	39.72808635024606	3.465659414541448e-285	2865	15166
Montana	8.141732660971504	4.568690033718143e-16	2816	15031
Nebraska	34.51032791554692	9.482012423652188e-226	2859	15084
Nevada	1.074955252609037	0.2824787398023296	2861	15158
New Hampshire	-54.8132332975776	0.0	2825	15117
New Jersey	-33.673471308013426	1.0572648188786253e-214	2865	15165
New Mexico	-7.955088952141924	1.9165337214792595e-15	2855	15148
New York	-59.787315534001614	0.0	2842	15164
North Carolina	11.535368680963725	3.22688336236172e-30	2862	15091
North Dakota	42.76238575352673	4.6998281e-316	2808	13457
Ohio	22.34007934724878	2.0868873495178739e-103	2865	15167
Oklahoma	57.928751914885154	0.0	2864	15131
Oregon	-43.40063765607903	0.0	2865	15167
Pennsylvania	4.595720522795659	4.48380871770576e-06	2860	15167
Rhode Island	-77.53618454679324	0.0	2734	15069
South Carolina	66.52251079674026	0.0	2862	15151
South Dakota	29.366913002113	3.452503931782634e-170	2820	14315
Tennessee	56.058472604432595	0.0	2865	15167
Texas	39.353718345240225	2.0236881102874325e-272	2842	15147
Unknown	-0.6030163311123652	0.5477016052246034	100	824
Utah	-5.33680018368585	1.0001041539065287e-07	2863	15153
Vermont	-98.46038216021982	0.0	2671	14925
Virginia	1.5452654913941575	0.12237767001739883	2837	15155
Washington	-48.022590592193566	0.0	2865	15166
Washington D.C	-5.575846221798112	2.82067900812857e-08	1636	14585
West Virginia	47.67832081504691	0.0	2860	14982
Wisconsin	-25.111085944983436	2.901923798451396e-134	2865	15167
Wyoming	39.60214666192522	8.227894035097481e-277	2797	14386

Table 13. Observational Study, Non-Targeted Ads: t Values and associated p values for each state destination for ads receiving 1K - 10K impressions.

U.S. State	t Value	p Value	$N_{contrarians}$	$N_{advocates}$
Alabama	29.337242287432815	2.1657971941601314e-165	2746	9927
Alaska	-5.42790809789668	5.807387231283471e-08	2685	9927
Arizona	-9.625441130612389	7.505900836060769e-22	2746	9962
Arkansas	57.586758996324825	0.0	2746	9954
California	-50.036238993682986	0.0	2744	9947
Colorado	1.6801365404771518	0.09303455161933309	2730	9931
Connecticut	-83.83337069621916	0.0	2744	9963
Delaware	-6.229884574357878	5.230003015254755e-10	2726	9931
Florida	-2.086838295395721	0.03693216347370386	2746	9943
Georgia	21.531300417712934	1.013752764709119e-100	2746	9952
Hawaii	-19.383355625188976	2.5825905591861803e-82	2729	9740
Idaho	17.397496541196354	4.007924004107575e-65	2735	9950
Illinois	-26.730814411035	4.604734014387288e-151	2746	9859
Indiana	21.6447700092822	1.43907366557751e-99	2745	9964
Iowa	10.431866515700973	3.7653777322982024e-25	2743	9964
Kansas	30.250682911169683	1.9581314031351082e-178	2740	9791
Kentucky	40.54486076713236	1.1629662224427878e-290	2741	9964
Louisiana	28.616692277991202	2.1393720431108264e-158	2705	9945
Maine	-14.774456990691004	6.370417611806881e-49	2743	9946
Maryland	-6.776752352540875	1.4481328043307854e-11	2746	9964
Massachusetts	-99.32658947109303	0.0	2746	9963
Michigan	-1.4667894548148488	0.14250083168985023	2746	9964
Minnesota	1.7673289303758404	0.0772820207410219	2746	9921
Mississippi	57.70624411087812	0.0	2722	9915
Missouri	28.82767659034072	1.9977540998387553e-163	2745	9964
Montana	3.0015319606554254	0.0026998026428570365	2732	9928
Nebraska	8.309777010385462	1.0628138057825682e-16	2744	9960
Nevada	-1.8978585355298083	0.057800496378809005	2746	9962
New Hampshire	-32.92612681751328	2.2449910431602332e-226	2733	9946
New Jersey	-23.713395828718408	3.6477270175978487e-116	2746	9962
New Mexico	-6.774640564204095	1.3068560941944714e-11	2741	9959
New York	-16.076602121935846	4.0113814278691505e-56	2736	9957
North Carolina	7.204428579563328	7.202718610408406e-13	2738	9944
North Dakota	32.694673637167995	1.9652022495301925e-211	2725	9816
Ohio	15.37671640646299	6.830224487355178e-52	2745	9964
Oklahoma	47.74304225274822	0.0	2744	9960
Oregon	-22.264615876920136	9.671624107820819e-102	2746	9964
Pennsylvania	6.042987684089745	1.6867064089524858e-09	2736	9964
Rhode Island	-89.65885566610692	0.0	2696	9929
South Carolina	46.32052198182565	0.0	2738	9954
South Dakota	27.447399451815034	5.1215569068082436e-151	2726	9880
Tennessee	30.81851988643652	3.1163515504432215e-199	2746	9964
Texas	28.636355688897122	1.496078693844873e-158	2718	9951
Unknown	-7.407836236879084	2.0006613762618722e-13	288	1488
Utah	-8.578085844297075	1.243346521199983e-17	2745	9961
Vermont	-101.65975264033875	0.0	2687	9878
Virginia	2.9020486797766085	0.0037324549373171966	2744	9944
Washington	-56.11336908956454	0.0	2746	9954
Washington D.C	-5.237437251570625	1.7261425554144176e-07	2518	9855
West Virginia	42.70281584660173	1.2003812146e-313	2740	9950
Wisconsin	-12.922905696448678	5.85141452633119e-38	2746	9964
Wyoming	35.115185249160106	8.418257788274953e-231	2715	9881

Table 14. Observational Study, Non-Targeted Ads: t Values and associated p values for each state destination for ads receiving 10K - 100K impressions.

U.S. State	t Value	p Value	$N_{contrarians}$	$N_{advocates}$
Alabama	36.6355152596689	9.465273742117823e-211	1174	2759
Alaska	-13.63175370114572	5.470423540390248e-41	1149	2750
Arizona	-5.9053936956825135	3.817779948155841e-09	1174	2757
Arkansas	33.61570023146241	9.002299876604879e-185	1174	2760
California	-31.596846124572686	3.5426906860853187e-177	1174	2761
Colorado	9.274439714327457	8.318981943736975e-20	1172	2746
Connecticut	-49.86321948306464	0.0	1174	2758
Delaware	-11.289031959810321	1.0605185829072139e-28	1171	2761
Florida	-5.686362905252525	1.3933866457552932e-08	1174	2758
Georgia	6.6926502996593475	2.502651546887858e-11	1174	2757
Hawaii	-9.05568399044438	2.4819883248327207e-19	1173	2708
Idaho	11.782633847207226	7.262905805005865e-31	1174	2760
Illinois	-22.765973163797263	1.3863842247310754e-102	1174	2733
Indiana	13.883514024120268	2.0040232945992106e-41	1174	2761
Iowa	3.785816414502519	0.00015554094368450407	1174	2761
Kansas	6.926208471121748	5.114283682230183e-12	1174	2744
Kentucky	24.765996279892605	1.89843523372986e-114	1170	2761
Louisiana	18.691273712983595	2.962449198708299e-70	1153	2754
Maine	-5.342831258810659	9.889426080967141e-08	1173	2759
Maryland	-11.880833444855682	1.1375444370554657e-31	1174	2761
Massachusetts	-46.07113952234258	0.0	1174	2761
Michigan	-2.6517495694628175	0.008045351166874777	1174	2757
Minnesota	2.9869271312872057	0.0028762227526366456	1174	2753
Mississippi	33.37388110582081	8.7496577908367e-182	1162	2732
Missouri	17.958111358524906	8.990316920763547e-66	1174	2761
Montana	2.677577606494775	0.007469020595212828	1174	2757
Nebraska	14.910799046132343	2.0503160530794055e-48	1174	2759
Nevada	-4.614355465636111	4.1174993874554415e-06	1174	2761
New Hampshire	-6.142731843749974	9.220432129695069e-10	1174	2759
New Jersey	-18.32231765490545	1.5745544323492222e-68	1174	2760
New Mexico	-3.1059923482223604	0.0019126903875989376	1174	2761
New York	-16.13600221476702	7.153924184188014e-55	1171	2760
North Carolina	6.46400361740306	1.1702730123495602e-10	1169	2759
North Dakota	22.981368913820432	1.36432345660597e-100	1172	2741
Ohio	8.082947658258313	1.2337320463300144e-15	1174	2761
Oklahoma	31.285632379588993	2.0472932698208477e-164	1174	2761
Oregon	-36.69636404589719	3.9164722225942664e-250	1174	2761
Pennsylvania	0.8717843500979894	0.38346136435343015	1170	2761
Rhode Island	-55.076344858379265	0.0	1172	2754
South Carolina	24.47674986307252	1.2969526356167794e-112	1169	2757
South Dakota	16.424749213986175	7.466420053674055e-58	1170	2757
Tennessee	19.74733418390985	8.258449081791918e-82	1174	2761
Texas	15.349829465228122	3.268499129736852e-49	1167	2755
Unknown	-1.1124202614027794	0.2664738949125134	282	1024
Utah	-9.71038929260595	5.977901212554979e-22	1174	2756
Vermont	-47.219446478439394	0.0	1172	2756
Virginia	-4.067579049218708	4.863811210783095e-05	1174	2755
Washington	-37.928046764256436	1.774483304121753e-257	1174	2738
Washington D.C	-5.9440860382273994	3.363442236572693e-09	1160	2729
West Virginia	28.512202790944613	2.020757308437381e-147	1174	2760
Wisconsin	-3.7825419741802024	0.00015821165644089782	1174	2761
Wyoming	23.95646312227408	1.973415418683927e-110	1172	2757

Table 15. Observational Study, Non-Targeted Ads: t Values and associated p values for each state destination for ads receiving 100K - 1M impressions.

U.S. State	t Value	p Value	$N_{contrarians}$	$N_{advocates}$
Alabama	12.147375988438649	1.4167945330679985e-27	166	187
Alaska	-3.4890194108552675	0.0005479199848896388	164	183
Arizona	-4.244923825966461	2.9833834498326144e-05	166	187
Arkansas	12.569147189027678	1.878946774200173e-28	166	187
California	-15.944919193482804	9.804233845260503e-42	166	187
Colorado	2.3595100517698775	0.019463836836519015	166	187
Connecticut	-17.249010472423567	5.0127050407154034e-48	166	187
Delaware	-2.3504345460406024	0.019595794013169975	165	187
Florida	-3.1171190162142324	0.0020029229719374726	166	187
Georgia	0.7952798468356714	0.42699150654237983	166	187
Hawaii	-14.375479444517813	8.370262783247808e-37	164	186
Idaho	5.2845054725339216	2.6623727146747085e-07	166	187
Illinois	-10.131705694472343	3.5691723131780661e-21	166	187
Indiana	3.937639242022996	0.00010528962870577128	166	187
Iowa	4.222590681204597	3.472560969994177e-05	166	187
Kansas	6.214720941177055	1.8896350504077196e-09	166	187
Kentucky	8.118824080821598	1.6482652263981894e-14	166	187
Louisiana	2.8219014026453553	0.005356458724075885	166	187
Maine	-1.2064871730354885	0.22915753283563844	166	187
Maryland	-5.7166290834405595	3.390556709044261e-08	166	187
Massachusetts	-21.01448936012711	1.9024039270367288e-62	166	187
Michigan	-1.9109853981705454	0.05682112898399593	166	187
Minnesota	2.041875469517014	0.04275181452309378	166	187
Mississippi	11.844284533895292	2.865327534962768e-26	166	184
Missouri	6.8321409176608086	5.90934604360631e-11	166	187
Montana	3.7976624836474357	0.00017513455774991344	166	187
Nebraska	6.312708990894015	1.0684160007277552e-09	166	187
Nevada	-6.397701913882775	8.411654582898472e-10	166	187
New Hampshire	-7.130528703491508	5.741972944664797e-12	166	187
New Jersey	-5.482453381426215	1.115735967488774e-07	166	187
New Mexico	-2.282969082471228	0.023074903479656492	166	187
New York	-10.158670764654046	4.907693483410212e-21	166	187
North Carolina	2.204745360152666	0.02842462740283445	165	187
North Dakota	6.957081302438876	5.725166062899278e-11	166	186
Ohio	1.8780489280540296	0.06157042473824639	166	187
Oklahoma	10.547839603410793	2.7236102701809117e-21	166	187
Oregon	-9.917812221871584	1.916295135598787e-20	166	187
Pennsylvania	-2.68863020638641	0.007576035163259341	166	187
Rhode Island	-20.716020365305027	1.350773570775954e-62	166	187
South Carolina	8.144436450801669	1.6843621937406653e-14	165	187
South Dakota	7.180495963483853	5.051268339710326e-12	165	187
Tennessee	8.48349343598714	1.9399482067693797e-15	166	187
Texas	4.359465875096533	2.1948979504702564e-05	166	187
Unknown	-2.821288102033652	0.005558597011479634	79	127
Utah	-5.836718139174142	1.2346250337914625e-08	166	187
Vermont	-11.44593239035457	2.5420049157315673e-25	166	187
Virginia	-2.8437363785197545	0.004805949040730133	166	187
Washington	-11.80327691785285	4.775768739848569e-27	166	186
Washington D.C	-6.7076731088976045	1.679046684915258e-10	163	187
West Virginia	10.605237453321472	1.8499208691671208e-22	166	187
Wisconsin	1.048421962452744	0.295962162167598	166	187
Wyoming	9.922110725315463	3.5077487383236865e-19	166	187

Table 16. Observational Study, Non-Targeted Ads: t Values and associated p values for each state destination for ads receiving 1M+ impressions.

Gender	t Value	p Value	Impression sub-division	$N_\text{contrarians}$	$N_\text{advocates}$
unknown	-59.60088925907019	0.0	< 1K	28010	111087
female	-97.10111437343016	0.0	< 1K	106506	236915
male	102.44394249827462	0.0	< 1K	108962	232187
unknown	-168.77328336281914	0.0	< 10K	95883	253225
female	-124.58471487192271	0.0	< 10K	141922	292969
male	115.7166994377231	0.0	< 10K	143406	289853
unknown	-121.16766460719253	0.0	< 100K	77940	173670
female	-100.70275663539485	0.0	< 100K	84305	178618
male	89.31311023365433	0.0	< 100K	84922	177609
unknown	-32.957934721755535	7.962730352268168e-236	< 1M	22021	43209
female	-45.784473656143255	0.0	< 1M	22450	43395
male	39.67812445269567	0.0	< 1M	22549	43066
unknown	-13.046496788671366	8.95595785159375e-38	1M+	2191	2393
female	-11.544436256615667	2.1485467554794404e-30	1M+	2183	2341
male	12.265838192270873	5.229702111203309e-34	1M+	2212	2308

Table 17. Observational Study: t Values and associated p values for each gender destination for ads across all impression classes.

Mean Delivery Percentage (Males)	Mean Delivery Percentage (Females)	Impression sub-division	$N_\text{ads targeted at males}$	$N_\text{ads targeted at females}$
355.999989	363.000008	< 1K	1511	1441
710.9999829999999	435.000001	1K - 10K	3150	1839
310.000006	183.999995	10K - 100K	1329	841
99.000006	88.000002	100K - 1M	373	325
30.0	14.999998000000001	1M+	70	46

Table 18. Observational Study: t Values and associated p values for each gender destination for ads across all impression classes.

Gender	t Value	p Value	Impression sub-division	$N_\text{contrarians}$	$N_\text{advocates}$
unknown	-30.28802255890723	3.1754600502463557e-177	< 1K	1483	15499
male	32.61562753682927	1.9909430829092287e-205	< 1K	3428	22077
female	-34.572363564160426	7.406451724015186e-234	< 1K	3359	22190
unknown	-22.213467618583373	4.2084778862737495e-98	< 10K	738	3982
male	13.264519919956074	4.767025239339843e-37	< 10K	826	4124
female	-12.343077251302159	2.9166788230990206e-33	< 10K	825	4125
unknown	-19.3228838763063	1.795806652367272e-76	< 100K	497	1526
male	11.924245970453422	7.060401628376165e-30	< 100K	511	1529
female	-11.237579420828638	6.123916371010068e-28	< 100K	509	1531
unknown	-4.777145065199948	3.1367517374290717e-06	< 1M	80	161
male	4.557210833796518	1.3254789205093724e-05	< 1M	81	152
female	-4.2583601247444935	3.1002777419026356e-05	< 1M	79	152
unknown	-11.750517442129782	1.8095059573890114e-30	1M+	1005	1157
male	13.894464689721922	9.075404859213381e-42	1M+	974	1111
female	-10.504585088444019	3.823310689178778e-25	1M+	974	1110

Table 19. Observational Study: t Values and associated p values for each gender destination for non-targeted ads across all impression classes.

Age	t Value	p Value	Impression Sub-Division	$N_{contrarians}$	$N_{advocates}$
65+	1.637078292124389	0.10161800665557924	< 1K	42124	99609
35	0.8237781751756732	0.4100680857744594	< 1K	41180	100674
55	17.593452567321243	3.8033242249070307e-69	< 1K	41265	97510
45	13.339167570988117	1.527758309195544e-40	< 1K	41164	96888
25	5.400874757979404	6.652028202123496e-08	< 1K	40572	100522
18	21.748839575685555	1.696347907025595e-104	< 1K	36038	80995
13	6.516764902706327	9.705057981521989e-11	< 1K	1130	3933
Unknown	43.0	0.00985313745046223	< 1K	5	58
65+	-5.113341654351778	3.169296905638893e-07	< 10K	65648	136294
35	6.510000719760764	7.543940964874341e-11	< 10K	64952	145753
55	24.76174975385475	4.927730123296646e-135	< 10K	65494	138366
45	28.914278770676038	3.8284028896523956e-183	< 10K	64966	140528
25	-15.032899303115636	4.943749253272434e-51	< 10K	63188	143719
18	-10.010693381861376	1.3964719175387654e-23	< 10K	55924	122328
13	-9.188122418458626	1.211964116167562e-19	< 10K	1020	8826
Unknown	1703.5	0.09537195117272297	< 10K	19	233
65+	3.515669743491021	0.0004388710464745124	< 100K	41269	83664
35	-0.609437321669196	0.5422363289182424	< 100K	42122	91270
55	24.17025631467193	1.3537794597471336e-128	< 100K	41474	85267
45	21.117221402256686	1.0767173007068109e-98	< 100K	41883	87865
25	-31.868486013574948	1.2459946548034853e-221	< 100K	41317	90238
18	-40.93362632205295	0.0	< 100K	37830	80907
13	-31.81824227462889	8.502385048163571e-212	< 100K	1201	10364
Unknown	0.92989431862337	0.3552733852163604	< 100K	71	322
65+	10.52661480767921	7.561060464396322e-26	< 1M	10838	19837
35	3.4682601907216273	0.0005249654016506202	< 1M	11316	22337
55	16.91290393077293	9.75449082511844e-64	< 1M	10995	20239
45	12.475171170826414	1.3703153041616054e-35	< 1M	11251	21102
25	-18.22404677347534	1.0146456011770687e-73	< 1M	11136	21890
18	-35.47923266484863	3.6812736294635867e-270	< 1M	10469	19908
13	-19.753530545075996	3.114274612111267e-83	< 1M	928	4254
Unknown	-1.2343471407958178	0.21865979706673974	< 1M	87	103
65+	6.82186672665088	1.196297618590318e-11	1M+	1041	1071
35	4.567545120077369	5.272241350216446e-06	1M+	1113	1182
55	8.340181315184173	1.360197690672556e-16	1M+	1064	1076
45	6.470773673304143	1.2067914864789076e-10	1M+	1082	1115
25	-3.1554524786773297	0.001624718821059442	1M+	1076	1144
18	-12.80409431294632	1.1413375161527457e-35	1M+	947	1077
13	-5.998466589195634	4.743810762132108e-09	1M+	232	371
Unknown	25.0	0.005348583655433198	1M+	31	6

Table 20. Observational Study: t Values and associated p values for each age destination for ads across all impression classes.

Age	Mean Delivery Percentage	Impression sub-division	$N_{\text{contrarians}}$
18	12.0	1K - 10K	18
65+	45.999998000000005	1K - 10K	135
35	22.0	1K - 10K	24
55	8.0	1K - 10K	8
45	21.0	1K - 10K	21
25	18.0	1K - 10K	18
13	0.0	1K - 10K	0
18	12.000001000000001	10K - 100K	14
65+	7.000001	10K - 100K	21
35	8.0	10K - 100K	14
55	1.9999999999999998	10K - 100K	6
45	1.0	10K - 100K	3
25	11.0	10K - 100K	15
13	0.0	10K - 100K	0
18	0.999999	100K - 1M	3
65+	0.0	100K - 1M	0
35	0.0	100K - 1M	0
55	0.0	100K - 1M	0
45	0.0	100K - 1M	0
25	0.0	100K - 1M	0
13	0.0	100K - 1M	0

Table 21. Observational Study, Targeted Ads: Mean delivery percentages for each age destination for ads across all impression classes.

Age	t Value	p Value	Impression Sub-Division	$N_{\text{contrarians}}$	$N_{\text{advocates}}$
55	10.13253509968088	1.619963675143212e-23	< 1K	1510	9933
65+	6.115165452338112	1.1616996418389305e-09	< 1K	1548	10314
35	-2.0167290698189344	0.04388236127624781	< 1K	1350	9987
18	-2.212795992772528	0.027064477797172033	< 1K	1189	9551
25	-8.598329728749883	1.7270045316697664e-17	< 1K	1323	10282
45	8.075492254596814	1.2935354585329297e-15	< 1K	1393	9769
13	303.0	0.019840951141236008	< 1K	7	56
Unknown	20.0	0.6835164835164834	< 1K	4	12
55	2.899526559855136	0.0038888609933062264	< 10K	406	2071
65+	-1.9229489903106958	0.054955810483125984	< 10K	406	2073
35	1.0519167415989288	0.29332326043908685	< 10K	401	2081
18	0.28684236183599754	0.7743590465251738	< 10K	363	1974
25	-2.7373351984129344	0.006373713686076371	< 10K	399	2073
45	4.177545531508531	3.485084094873736e-05	< 10K	405	2069
13	418.0	0.6077068841881581	< 10K	9	84
55	4.75089958780355	2.863910197169228e-06	< 100K	255	788
65+	1.6245292685167823	0.10500624932392018	< 100K	255	789
35	0.40372162482555074	0.6866386877809225	< 100K	254	789
18	-6.981477628553694	5.883530515640147e-12	< 100K	246	751
25	-5.765863705506993	1.2846014319710403e-08	< 100K	253	789
45	4.406986784090835	1.4111009540139541e-05	< 100K	255	789
13	465.5	0.19506182269418393	< 100K	14	85
Unknown	2.0	1.0	< 100K	1	5
55	3.897721179101654	0.00026638689333346533	< 1M	39	84
65+	4.968205464940024	9.639738063090913e-06	< 1M	39	84
35	-2.4550411943419443	0.015769742020848593	< 1M	39	84
18	-5.359615762731805	8.548003685195864e-07	< 1M	39	75
25	-6.4044829748664664	4.406432283550504e-09	< 1M	39	84
45	1.455770430524272	0.15028358914889986	< 1M	39	84
13	43.5	0.41562119091674266	< 1M	5	23
55	9.926551917632503	4.619523116414099e-22	1M+	498	561
65+	8.089338479885482	1.994013383471089e-15	1M+	498	561
35	1.4341773176929462	0.15184038601811023	1M+	497	561
18	-12.84532799254759	1.080126648927318e-33	1M+	472	543
25	-8.521071710025634	5.688651145745444e-17	1M+	497	561
45	8.269413353316834	4.956710773876618e-16	1M+	498	561
13	-4.437529878494725	1.652627749764614e-05	1M+	106	132
Unknown	15.0	0.8470554350675606	1M+	26	1

Table 22. Observational Study, Non-Targeted Ads: t Values and associated p values for each age destination for non-targeted ads across all impression classes.

U.S. State	H-statistic, p-value
Alabama	(10.38, 0.01)
Alaska	(20.63, 0.0)
Arizona	(41.19, 0.0)
Arkansas	(0.7, 0.71)
California	(13.54, 0.0)
Colorado	(41.2, 0.0)
Connecticut	(31.24, 0.0)
Delaware	(21.66, 0.0)
Florida	(3.23, 0.2)
Georgia	(1.01, 0.6)
Hawaii	(13.36, 0.0)
Idaho	(10.49, 0.01)
Illinois	(9.74, 0.01)
Indiana	(4.66, 0.1)
Iowa	(10.03, 0.01)
Kansas	(8.49, 0.01)
Kentucky	(14.16, 0.0)
Louisiana	(8.67, 0.01)
Maine	(27.79, 0.0)
Maryland	(31.25, 0.0)
Massachusetts	(43.94, 0.0)
Michigan	(4.73, 0.09)
Minnesota	(13.15, 0.0)
Mississippi	(4.1, 0.13)
Missouri	(1.42, 0.49)
Montana	(18.5, 0.0)
Nebraska	(7.93, 0.02)
Nevada	(29.7, 0.0)
New Hampshire	(29.08, 0.0)
New Jersey	(13.19, 0.0)
New Mexico	(13.23, 0.0)
New York	(20.47, 0.0)
North Carolina	(2.52, 0.28)
North Dakota	(26.96, 0.0)
Ohio	(12.55, 0.0)
Oklahoma	(32.05, 0.0)
Oregon	(22.74, 0.0)
Pennsylvania	(11.89, 0.0)
Rhode Island	(11.39, 0.0)
South Carolina	(2.54, 0.28)
South Dakota	(10.34, 0.01)
Tennessee	(5.81, 0.05)
Texas	(42.88, 0.0)
Utah	(20.56, 0.0)
Vermont	(21.09, 0.0)
Virginia	(5.12, 0.08)
Washington	(15.18, 0.0)
West Virginia	(1.08, 0.58)
Wisconsin	(7.83, 0.02)
Wyoming	(16.69, 0.0)

Table 23. H-statistic and p-values from the Kruskal-Wallis H-tests testing the null hypothesis that the population median of ads featuring solar cells, oil rigs, and controls are different.

Gender	(H-statistic, p-value)
Female	(324.71, 0.0)
Male	(321.33, 0.0)
Unknown	(36.96, 0.0)

Table 24. H-statistic and p-values from the Kruskal-Wallis H-tests testing the null hypothesis that the population median of ads featuring solar cells, oil rigs, and controls are different.

Age	(H-statistic, p-value)
18-24	(113.96, 0.0)
25-34	(73.85, 0.0)
35-44	(7.59, 0.02)
45-54	(6.29, 0.04)
55-64	(19.34, 0.0)
65+	(48.68, 0.0)

Table 25. H-statistic and p-values from the Kruskal-Wallis H-tests testing the null hypothesis that the population median of ads featuring solar cells, oil rigs, and controls are different.

Region	H-statistic and p-value (Oil rigs)	H-statistic and p-value (Solar Cells)
Alabama	(1.13, 0.57)	(0.52, 0.77)
Alaska	(3.91, 0.14)	(0.05, 0.97)
Arizona	(1.55, 0.46)	(2.51, 0.29)
Arkansas	(1.74, 0.42)	(3.9, 0.14)
California	(1.01, 0.6)	(7.14, 0.03)
Colorado	(1.59, 0.45)	(1.21, 0.55)
Connecticut	(7.5, 0.02)	(1.1, 0.58)
Delaware	(0.88, 0.65)	(0.86, 0.65)
Florida	(2.93, 0.23)	(0.84, 0.66)
Georgia	(4.06, 0.13)	(2.8, 0.25)
Hawaii	(4.2, 0.12)	(2.15, 0.34)
Idaho	(14.07, 0.0)	(0.24, 0.89)
Illinois	(0.41, 0.82)	(1.85, 0.4)
Indiana	(0.42, 0.81)	(1.05, 0.59)
Iowa	(0.1, 0.95)	(0.47, 0.79)
Kansas	(0.65, 0.72)	(0.6, 0.74)
Kentucky	(1.03, 0.6)	(1.79, 0.41)
Louisiana	(0.02, 0.99)	(0.43, 0.81)
Maine	(0.37, 0.83)	(0.69, 0.71)
Maryland	(1.78, 0.41)	(0.48, 0.79)
Massachusetts	(4.06, 0.13)	(5.94, 0.05)
Michigan	(0.58, 0.75)	(6.57, 0.04)
Minnesota	(3.07, 0.22)	(0.37, 0.83)
Mississippi	(5.19, 0.07)	(0.05, 0.98)
Missouri	(3.87, 0.14)	(4.28, 0.12)
Montana	(3.35, 0.19)	(7.67, 0.02)
Nebraska	(1.95, 0.38)	(0.46, 0.8)
Nevada	(0.83, 0.66)	(7.74, 0.02)
New Hampshire	(0.35, 0.84)	(2.41, 0.3)
New Jersey	(0.45, 0.8)	(1.2, 0.55)
New Mexico	(6.79, 0.03)	(0.89, 0.64)
New York	(0.78, 0.68)	(6.66, 0.04)
North Carolina	(1.58, 0.45)	(1.04, 0.6)
North Dakota	(0.39, 0.82)	(2.03, 0.36)
Ohio	(0.67, 0.72)	(3.16, 0.21)
Oklahoma	(0.07, 0.97)	(1.0, 0.61)
Oregon	(0.61, 0.74)	(0.25, 0.88)
Pennsylvania	(0.68, 0.71)	(0.29, 0.86)
Rhode Island	(0.0, 1.0)	(2.09, 0.35)
South Carolina	(4.54, 0.1)	(0.14, 0.93)
South Dakota	(0.64, 0.73)	(8.78, 0.01)
Tennessee	(2.65, 0.27)	(1.63, 0.44)
Texas	(1.0, 0.61)	(1.04, 0.6)
Utah	(4.75, 0.09)	(1.1, 0.58)
Vermont	(3.61, 0.16)	(0.02, 0.99)
Virginia	(5.35, 0.07)	(1.46, 0.48)
Washington	(0.96, 0.62)	(4.16, 0.12)
West Virginia	(4.35, 0.11)	(1.78, 0.41)
Wisconsin	(0.33, 0.85)	(1.75, 0.42)
Wyoming	(4.22, 0.12)	(0.17, 0.92)

Table 26. H-statistic and p-values from the Kruskal-Wallis H-tests testing the null hypothesis that the population medians of ads featuring solar cells and oil rigs with no logo, with the logo of an advocacy organization and the logo of a contrarian organization are different.

Gender	H Statistic and p-value (Oil rigs)	H Statistic and p-value (Solar cells)
female	(0.09,0.96)	(5.7, 0.06)
male	(0.18, 0.91)	(5.36, 0.07)
unknown	(6.68, 0.04)	(0.71, 0.7)

Table 27. H-statistic and p-values from the Kruskal-Wallis H-tests testing the null hypothesis that the population medians of ads featuring solar cells and oil rigs with no logo, with the logo of an advocacy organization and the logo of a contrarian organization are different.

Age	H Statistic and p-value (Oil rigs)	H Statistic and p-value (Solar cells)
18-24	(2.74 0.25)	(6.88, 0.03)
25-34	(0.05 0.98)	(23.63, 0.0)
35-44	(1.84 0.4)	(11.59, 0.0)
45-54	(3.11 0.21)	(1.31, 0.52)
55-64	(1.07 0.59)	(3.46, 0.18)
65+	(0.21 0.9)	(15.82, 0.0)

Table 28. H-statistic and p-values from the Kruskal-Wallis H-tests testing the null hypothesis that the population medians of ads featuring solar cells and oil rigs with no logo, with the logo of an advocacy organization and the logo of a contrarian organization are different.

Ad ID	Solar Cells			Oil rigs			Controls		
	Batch 1	Batch 2	Batch 3	Batch 1	Batch 2	Batch 3	Batch 1	Batch 2	Batch 3
1	0.12	0.56	0.53	0.01	1.0	0.34	1.0	0.73	0.55
2	1.0	0.06	1.0	0.49	0.01	1.0	0.53	1.0	0.15
3	1.0	1.0	0.54	0.01	0.77	0.37	0.56	0.19	0.28
4	0.5	1.0	0.23	0.46	0.36	0.69	0.11	0.63	0.26
5	1.0	0.67	0.52	0.63	0.56	1.0	0.65	0.02	0.23
6	1.0	1.0	0.44	0.69	0.13	0.48	0.41	0.02	0.76
7	0.6	1.0	0.31	1.0	1.0	0.14	0.39	0.76	0.34
8	1.0	0.17	0.42	1.0	1.0	0.9	1.0	0.27	1.0
9	1.0	0.36	0.53	0.03	0.73	1.0	0.14	0.07	0.2
10	1.0	0.92	0.22	1.0	0.34	0.04	0.06	1.0	1.0
11	0.59	1.0	0.09	1.0	0.77	0.06	0.63	0.58	0.02
12	0.25	0.17	1.0	0.53	0.0	0.2	0.54	0.74	1.0
13	0.1	1.0	0.26	0.64	1.0	0.85	0.42	0.71	0.75
14	0.3	0.03	0.03	0.54	0.33	0.89	0.54	0.06	1.0
15	0.38	1.0	0.73	0.25	0.14	0.9	0.12	0.11	0.12
16	0.08	0.48	0.0	0.73	0.0	1.0	0.48	0.44	0.91
17	1.0	1.0	0.04	0.35	1.0	0.1	0.06	0.57	0.35
18	0.04	1.0	0.09	0.04	0.69	1.0	0.76	0.02	1.0
19	0.49	1.0	0.03	0.27	0.45	0.08	0.55	0.51	0.5
20	0.12	0.64	1.0	1.0	0.0	0.48	0.81	1.0	0.71
21	1.0	0.55	1.0	0.51	0.0	0.5	1.0	0.59	0.32
22	0.46	0.06		0.51	0.08		0.14	1.0	

Table 29. Table showing p-values for the Two Sided Fisher's Exact Test. The test measures if observed ad delivery in different U.S. state based ad destinations was consistent between 2 ads featuring the same image and run at the same time. p-values were calculated using the exact test, without using Monte-carlo simulations. Confidence intervals, and an estimate of the odds ratio are not available since this is a 14x2 dataset. Delivery of 65 associated solar cell, oil rig and control ad pairs split into 3 batches were compared.

Ad ID	Solar Cells			Oil rigs			Controls		
	Batch 1	Batch 2	Batch 3	Batch 1	Batch 2	Batch 3	Batch 1	Batch 2	Batch 3
1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
11	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
12	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
13	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
14	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
15	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
16	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
17	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
18	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
19	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
20	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
21	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
22	1.0	1.0		1.0	1.0		1.0	1.0	

Table 30. Table showing p-values for the Two Sided Fisher's Exact Test. The test measures if observed ad delivery in different gender based ad destinations was consistent between 2 ads featuring the same image and run at the same time. p-values were calculated using the exact test, without using Monte-carlo simulations. Confidence intervals, and an estimate of the odds ratio are not available since this is a 3x2 dataset. Delivery of 65 associated solar cell, oil rig and control ad pairs split into 3 batches were compared.

Ad ID	Solar Cells			Oil rigs			Controls		
	Batch 1	Batch 2	Batch 3	Batch 1	Batch 2	Batch 3	Batch 1	Batch 2	Batch 3
1	1.0	1.0	1.0	1.0	1.0	1.0	0.2	1.0	1.0
2	0.07	1.0	1.0	1.0	1.0	0.5	0.07	1.0	0.5
3	1.0	1.0	1.0	1.0	0.4	0.2	1.0	1.0	0.2
4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.07
5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.07	==0.05==
6	1.0	0.2	1.0	0.2	1.0	1.0	1.0	1.0	0.13
7	0.2	1.0	1.0	1.0	1.0	1.0	1.0	0.4	1.0
8	1.0	1.0	1.0	1.0	1.0	0.5	1.0	0.07	1.0
9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10	1.0	0.4	1.0	0.5	1.0	1.0	0.13	1.0	1.0
11	1.0	1.0	1.0	1.0	1.0	0.07	1.0	1.0	0.4
12	1.0	1.0	1.0	1.0	1.0	0.4	1.0	0.07	1.0
13	1.0	0.2	0.2	0.2	0.4	1.0	1.0	0.2	1.0
14	1.0	1.0	1.0	0.07	0.5	1.0	1.0	0.4	1.0
15	1.0	1.0	1.0	1.0	0.2	1.0	1.0	1.0	0.2
16	1.0	1.0	1.0	1.0	1.0	1.0	0.07	0.2	1.0
17	1.0	0.4	1.0	1.0	1.0	1.0	1.0	0.2	1.0
18	1.0	1.0	1.0	1.0	1.0	0.02	0.4	0.2	0.07
19	0.2	1.0	1.0	1.0	0.13	1.0	1.0	1.0	1.0
20	1.0	1.0	1.0	0.07	1.0	1.0	1.0	1.0	1.0
21	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
22	1.0	1.0		1.0	1.0		1.0	1.0	

Table 31. Table showing p-values for the Two Sided Fisher's Exact Test. The test measures if observed ad delivery in different age based ad destinations was consistent between 2 ads featuring the same image and run at the same time. p-values were calculated using the exact test, without using Monte-carlo simulations. Confidence intervals, and an estimate of the odds ratio are not available since this is a 6x2 dataset. Delivery of 65 associated solar cell, oil rig and control ad pairs split into 3 batches were compared.

Ad ID	Solar Cells	Solar Cells (Copy)	Solar Cells + Contrarian Logo	Solar Cells + Advocacy Logo	Oil rigs	Oil rigs (Copy)	Oil rigs + Contrarian Logo	Oil rigs + Advocacy Logo	Controls	Controls (Copy)	df
1	(104.95, 0.0)	(106.24, 0.0)	(116.97, 0.0)	(76.82, 0.01)	(89.09, 0.0)	(62.19, 0.12)	(93.37, 0.0)	(118.92, 0.0)	(118.72, 0.0)	(77.22, 0.01)	50.0
2	(109.51, 0.0)	(86.17, 0.0)	(78.15, 0.01)	(79.53, 0.0)	(76.79, 0.01)	(90.42, 0.0)	(108.25, 0.0)	(92.04, 0.0)	(66.72, 0.06)	(73.0, 0.02)	50.0
3	(88.01, 0.0)	(112.27, 0.0)	(82.11, 0.0)	(108.85, 0.0)	(75.29, 0.01)	(128.11, 0.0)	(72.49, 0.02)	(94.48, 0.0)	(109.75, 0.0)	(76.67, 0.01)	50.0
4	(163.81, 0.0)	(208.42, 0.0)	(157.19, 0.0)	(91.36, 0.0)	(120.11, 0.0)	(59.43, 0.17)	(59.77, 0.16)	(88.37, 0.0)	(44.52, 0.69)	(50.24, 0.46)	50.0
5	(143.41, 0.0)	(52.59, 0.37)	(51.76, 0.41)	(223.41, 0.0)	(78.73, 0.01)	(111.96, 0.0)	(96.15, 0.0)	(97.94, 0.0)	(112.85, 0.0)	(48.15, 0.55)	50.0
6	(73.44, 0.02)	(106.57, 0.0)	(78.25, 0.01)	(69.79, 0.03)	(56.11, 0.26)	(117.85, 0.0)	(98.64, 0.0)	(63.06, 0.1)	(63.02, 0.1)	(83.72, 0.0)	50.0
7	(127.21, 0.0)	(78.81, 0.01)	(91.82, 0.0)	(126.46, 0.0)	(70.61, 0.03)	(129.3, 0.0)	(63.54, 0.09)	(51.12, 0.43)	(88.53, 0.0)	(69.61, 0.03)	50.0
8	(59.21, 0.17)	(102.69, 0.0)	(92.73, 0.0)	(85.69, 0.0)	(72.79, 0.02)	(129.47, 0.0)	(37.93, 0.89)	(92.84, 0.0)	(100.01, 0.0)	(49.32, 0.5)	50.0
9	(51.3, 0.42)	(95.26, 0.0)	(140.48, 0.0)	(39.67, 0.85)	(80.14, 0.0)	(77.47, 0.01)	(74.27, 0.01)	(69.22, 0.04)	(55.8, 0.27)	(65.28, 0.07)	50.0
10	(76.54, 0.01)	(71.17, 0.03)	(84.64, 0.0)	(76.53, 0.01)	(84.02, 0.0)	(80.62, 0.0)	(64.81, 0.08)	(153.8, 0.0)	(64.28, 0.08)	(66.76, 0.06)	50.0
11	(110.5, 0.0)	(76.3, 0.01)	(77.94, 0.01)	(85.99, 0.0)	(91.35, 0.0)	(75.54, 0.01)	(88.27, 0.0)	(78.17, 0.01)	(88.79, 0.0)	(67.95, 0.05)	50.0
12	(60.0, 0.16)	(91.5, 0.0)	(48.01, 0.55)	(58.38, 0.19)	(59.82, 0.16)	(66.35, 0.06)	(111.38, 0.0)	(100.16, 0.0)	(52.23, 0.39)	(57.04, 0.23)	50.0
13	(54.32, 0.31)	(91.8, 0.0)	(103.74, 0.0)	(111.11, 0.0)	(73.33, 0.02)	(104.07, 0.0)	(62.15, 0.12)	(80.67, 0.0)	(79.55, 0.0)	(126.3, 0.0)	50.0
14	(56.35, 0.25)	(86.02, 0.0)	(113.53, 0.0)	(71.24, 0.03)	(79.7, 0.0)	(106.38, 0.0)	(59.57, 0.17)	(67.45, 0.05)	(55.78, 0.27)	(76.21, 0.01)	50.0
15	(108.33, 0.0)	(157.93, 0.0)	(89.92, 0.0)	(131.43, 0.0)	(87.01, 0.0)	(75.94, 0.01)	(54.7, 0.3)	(50.23, 0.46)	(69.54, 0.04)	(51.05, 0.43)	50.0
16	(91.1, 0.0)	(63.91, 0.09)	(69.22, 0.04)	(144.7, 0.0)	(95.62, 0.0)	(98.78, 0.0)	(98.1, 0.0)	(55.75, 0.27)	(58.98, 0.18)	(64.39, 0.08)	50.0
17	(88.82, 0.0)	(73.08, 0.02)	(107.32, 0.0)	(88.96, 0.0)	(99.38, 0.0)	(100.44, 0.0)	(96.55, 0.0)	(68.06, 0.05)	(70.22, 0.03)	(83.82, 0.0)	50.0
18	(84.16, 0.0)	(57.33, 0.22)	(59.56, 0.17)	(86.1, 0.0)	(63.16, 0.1)	(66.81, 0.06)	(84.33, 0.0)	(71.63, 0.02)	(119.09, 0.0)	(91.66, 0.0)	50.0
19	(128.59, 0.0)	(99.51, 0.0)	(87.01, 0.0)	(86.74, 0.0)	(82.97, 0.0)	(86.93, 0.0)	(94.82, 0.0)	(264.14, 0.0)	(38.93, 0.87)	(69.34, 0.04)	50.0
20	(106.34, 0.0)	(93.06, 0.0)	(76.36, 0.01)	(105.89, 0.0)	(71.71, 0.02)	(56.53, 0.24)	(54.42, 0.31)	(81.16, 0.0)	(59.0, 0.18)	(51.02, 0.43)	50.0
21	(95.32, 0.0)	(83.27, 0.0)	(71.39, 0.03)	(150.18, 0.0)	(117.22, 0.0)	(92.15, 0.0)	(146.39, 0.0)	(63.03, 0.1)	(71.51, 0.02)	(95.8, 0.31)	50.0
22	(188.79, 0.0)	(117.99, 0.0)	(68.71, 0.04)	(64.27, 0.08)	(80.6, 0.0)	(126.53, 0.0)	(100.78, 0.0)	(128.06, 0.0)	(48.36, 0.54)	(77.07, 0.01)	50.0

Table 32. Batch1: χ^2 **statistic and p values to test the hypothesis that the observed ad delivery in different U.S. states is proportional to the population estimates provided by Facebook. In a majority of ads, the observed ad delivery is not proportional to the population estimates from Facebook. The Chi Square test was not able to be performed for the highlighted values.**

Ad ID	Solar Cells	Solar Cells (Copy)	Solar Cells + Contrarian Logo	Solar Cells + Advocacy Logo	Oil rigs	Oil rigs (Copy)	Oil rigs + Contrarian Logo	Oil rigs + Advocacy Logo	Controls	Controls (Copy)	df
1	(98.56, 0.0)	(74.01, 0.02)	(50.34, 0.46)	(55.08, 0.29)	(76.01, 0.01)	(172.15, 0.0)	(85.09, 0.0)	(78.18, 0.01)	(71.18, 0.03)	(82.85, 0.0)	50.0
2	(102.4, 0.0)	(80.59, 0.0)	(99.13, 0.0)	(86.78, 0.0)	(121.49, 0.0)	(80.14, 0.0)	(77.16, 0.01)	(83.76, 0.0)	(45.42, 0.66)	(103.1, 0.0)	50.0
3	(80.91, 0.0)	(90.0, 0.0)	(129.87, 0.0)	(43.34, 0.74)	(124.5, 0.0)	(72.14, 0.02)	(95.83, 0.0)	(116.18, 0.0)	(87.31, 0.0)	(89.58, 0.0)	50.0
4	(93.65, 0.0)	(137.15, 0.0)	(60.01, 0.16)	(107.83, 0.0)	(78.88, 0.01)	(53.07, 0.36)	(84.38, 0.0)	(98.94, 0.0)	(61.23, 0.13)	(52.87, 0.36)	50.0
5	(86.26, 0.0)	(80.23, 0.0)	(85.87, 0.0)	(101.13, 0.0)	(99.32, 0.0)	(101.56, 0.0)	(99.09, 0.0)	(122.46, 0.0)	(87.79, 0.0)	(69.13, 0.04)	50.0
6	(112.19, 0.0)	(110.53, 0.0)	(90.26, 0.0)	(109.3, 0.0)	(84.24, 0.0)	(69.09, 0.04)	(84.98, 0.0)	(77.28, 0.01)	(56.45, 0.25)	(59.43, 0.17)	50.0
7	(106.44, 0.0)	(132.26, 0.0)	(95.13, 0.0)	(122.91, 0.0)	(72.3, 0.02)	(74.6, 0.01)	(79.02, 0.01)	(61.13, 0.13)	(90.89, 0.0)	(64.1, 0.09)	50.0
8	(60.02, 0.16)	(60.08, 0.16)	(88.67, 0.0)	(122.13, 0.0)	(67.03, 0.05)	(89.8, 0.0)	(167.53, 0.0)	(93.99, 0.0)	(84.59, 0.0)	(80.59, 0.0)	50.0
9	(74.45, 0.01)	(104.81, 0.0)	(58.04, 0.2)	(82.17, 0.0)	(62.61, 0.11)	(90.72, 0.0)	(54.09, 0.32)	(105.85, 0.0)	(75.41, 0.01)	(79.02, 0.01)	50.0
10	(114.68, 0.0)	(199.3, 0.0)	(179.95, 0.0)	(73.14, 0.02)	(92.24, 0.0)	(112.91, 0.0)	(88.13, 0.0)	(63.02, 0.1)	(75.46, 0.01)	(89.4, 0.0)	50.0
11	(139.0, 0.0)	(99.67, 0.0)	(131.25, 0.0)	(92.24, 0.0)	(91.44, 0.0)	(98.07, 0.0)	(133.64, 0.0)	(81.82, 0.0)	(46.02, 0.63)	(55.47, 0.28)	50.0
12	(136.44, 0.0)	(63.68, 0.09)	(93.33, 0.0)	(92.44, 0.0)	(84.12, 0.0)	(129.34, 0.0)	(92.0, 0.0)	(83.06, 0.0)	(65.37, 0.07)	(51.25, 0.42)	50.0
13	(40.51, 0.83)	(172.55, 0.0)	(95.83, 0.0)	(96.4, 0.0)	(85.92, 0.0)	(85.23, 0.0)	(71.49, 0.02)	(57.52, 0.22)	(76.78, 0.01)	(68.3, 0.04)	50.0
14	(71.67, 0.02)	(130.78, 0.0)	(164.91, 0.0)	(87.88, 0.0)	(72.98, 0.02)	(118.84, 0.0)	(47.32, 0.58)	(74.04, 0.02)	(101.62, 0.0)	(84.82, 0.0)	50.0
15	(96.68, 0.0)	(98.11, 0.0)	(82.54, 0.0)	(69.58, 0.03)	(97.61, 0.0)	(85.45, 0.0)	(116.35, 0.0)	(79.89, 0.0)	(104.76, 0.0)	(31.7, 0.98)	50.0
16	(74.01, 0.02)	(138.75, 0.0)	(98.81, 0.0)	(158.47, 0.0)	(126.15, 0.0)	(152.81, 0.0)	(96.34, 0.0)	(67.31, 0.05)	(103.95, 0.0)	(106.62, 0.0)	50.0
17	(82.5, 0.0)	(128.22, 0.0)	(106.67, 0.0)	(77.7, 0.01)	(109.42, 0.0)	(88.15, 0.0)	(99.85, 0.0)	(114.56, 0.0)	(69.81, 0.03)	(107.25, 0.0)	50.0
18	(76.04, 0.01)	(74.81, 0.01)	(109.8, 0.0)	(111.11, 0.0)	(81.8, 0.0)	(75.17, 0.01)	(108.48, 0.0)	(99.75, 0.0)	(76.01, 0.01)	(49.49, 0.49)	50.0
19	(94.75, 0.0)	(90.15, 0.0)	(144.54, 0.0)	(62.77, 0.11)	(49.68, 0.49)	(96.47, 0.0)	(88.63, 0.0)	(125.28, 0.0)	(82.67, 0.0)	(59.48, 0.17)	50.0
20	(124.37, 0.0)	(63.24, 0.1)	(50.85, 0.44)	(106.72, 0.0)	(80.8, 0.0)	(79.84, 0.0)	(76.14, 0.01)	(66.45, 0.06)	(76.0, 0.01)	(143.05, 0.0)	50.0
21	(109.56, 0.0)	(133.78, 0.0)	(87.25, 0.0)	(136.85, 0.0)	(84.68, 0.0)	(66.16, 0.06)	(60.3, 0.15)	(72.58, 0.02)	(50.99, 0.43)	(58.4, 0.19)	50.0
22	(83.9, 0.0)	(47.85, 0.56)	(60.39, 0.15)	(99.85, 0.0)	(70.22, 0.03)	(90.22, 0.0)	(89.96, 0.0)	(147.39, 0.0)	(91.55, 0.0)	(76.6, 0.01)	50.0

Table 33. Batch2: χ^2 **statistic and p values to test the hypothesis that the observed ad delivery in different U.S. states is proportional to the population estimates provided by Facebook. In a majority of ads, the observed ad delivery is not proportional to the population estimates from Facebook. The Chi Square test was not able to be performed for the highlighted values.**

Ad ID	Solar Cells	Solar Cells (Copy)	Solar Cells + Contrarian Logo	Solar Cells + Advocacy Logo	Oil rigs	Oil rigs (Copy)	Oil rigs + Contrarian Logo	Oil rigs + Advocacy Logo	Controls	Controls (Copy)	df
1	(56.15, 0.26)	(76.29, 0.01)	(120.82, 0.0)	(129.39, 0.0)	(82.96, 0.0)	(67.05, 0.05)	(111.55, 0.0)	(144.61, 0.0)	(82.41, 0.0)	(75.7, 0.01)	50.0
2	(103.46, 0.0)	(45.43, 0.66)	(69.82, 0.03)	(91.97, 0.0)	(88.38, 0.0)	(112.53, 0.0)	(56.23, 0.25)	(81.43, 0.0)	(83.0, 0.0)	(51.76, 0.41)	50.0
3	(100.08, 0.0)	(82.08, 0.0)	(94.15, 0.0)	(106.96, 0.0)	(35.4, 0.94)	(99.9, 0.0)	(87.68, 0.0)	(74.96, 0.01)	(93.73, 0.0)	(96.57, 0.0)	50.0
4	(87.17, 0.0)	(75.94, 0.01)	(72.36, 0.02)	(59.21, 0.17)	(68.65, 0.04)	(173.72, 0.0)	(63.46, 0.1)	(104.6, 0.0)	(98.66, 0.0)	(56.61, 0.24)	50.0
5	(175.35, 0.0)	(87.64, 0.0)	(106.15, 0.0)	(56.92, 0.23)	(108.4, 0.0)	(103.01, 0.0)	(81.05, 0.0)	(124.17, 0.0)	(73.78, 0.0)	(82.22, 0.0)	50.0
6	(85.33, 0.0)	(78.0, 0.01)	(62.29, 0.11)	(73.52, 0.02)	(90.17, 0.0)	(95.55, 0.0)	(65.63, 0.07)	(58.39, 0.19)	(87.8, 0.0)	(107.88, 0.0)	50.0
7	(114.37, 0.0)	(65.28, 0.07)	(80.3, 0.0)	(37.1, 0.91)	(80.11, 0.0)	(91.93, 0.0)	(148.37, 0.0)	(55.74, 0.27)	(46.31, 0.62)	(42.23, 0.77)	50.0
8	(119.44, 0.0)	(83.23, 0.0)	(96.1, 0.0)	(162.83, 0.0)	(58.64, 0.19)	(117.64, 0.0)	(140.48, 0.0)	(82.33, 0.0)	(137.94, 0.0)	(72.56, 0.02)	50.0
9	(80.43, 0.0)	(167.22, 0.0)	(105.45, 0.0)	(78.67, 0.01)	(85.61, 0.0)	(65.75, 0.07)	(88.78, 0.0)	(72.07, 0.02)	(100.58, 0.0)	(178.92, 0.0)	50.0
10	(98.4, 0.0)	(114.45, 0.0)	(58.7, 0.19)	(56.52, 0.24)	(123.32, 0.0)	(82.62, 0.0)	(83.53, 0.0)	(105.16, 0.0)	(115.62, 0.0)	(99.46, 0.0)	50.0
11	(145.62, 0.0)	(132.34, 0.0)	(84.09, 0.0)	(67.4, 0.05)	(98.36, 0.0)	(78.12, 0.01)	(81.24, 0.0)	(76.28, 0.01)	(107.2, 0.0)	(71.97, 0.02)	50.0
12	(108.4, 0.0)	(82.18, 0.0)	(124.75, 0.0)	(111.42, 0.0)	(99.05, 0.0)	(77.79, 0.01)	(60.49, 0.15)	(79.04, 0.01)	(121.28, 0.0)	(68.45, 0.04)	50.0
13	(76.28, 0.01)	(139.4, 0.0)	(84.2, 0.0)	(109.85, 0.0)	(84.53, 0.0)	(106.61, 0.0)	(89.0, 0.0)	(99.93, 0.0)	(70.95, 0.03)	(83.73, 0.0)	50.0
14	(45.35, 0.66)	(101.0, 0.0)	(79.78, 0.0)	(51.63, 0.41)	(60.56, 0.15)	(50.03, 0.47)	(102.07, 0.0)	(71.49, 0.02)	(99.34, 0.0)	(120.22, 0.0)	50.0
15	(74.58, 0.01)	(88.26, 0.0)	(100.78, 0.0)	(126.71, 0.0)	(66.83, 0.06)	(79.3, 0.01)	(88.17, 0.0)	(78.04, 0.01)	(137.73, 0.0)	(64.26, 0.08)	50.0
16	(68.78, 0.04)	(62.84, 0.1)	(59.53, 0.17)	(75.44, 0.01)	(94.0, 0.0)	(63.42, 0.1)	(114.76, 0.0)	(62.78, 0.11)	(64.39, 0.08)	(57.58, 0.22)	50.0
17	(79.97, 0.0)	(134.0, 0.0)	(72.11, 0.02)	(71.85, 0.02)	(97.8, 0.0)	(73.4, 0.02)	(43.85, 0.72)	(119.27, 0.0)	(47.49, 0.57)	(61.72, 0.12)	50.0
18	(50.12, 0.47)	(125.92, 0.0)	(94.28, 0.0)	(79.73, 0.0)	(88.83, 0.0)	(87.96, 0.0)	(73.34, 0.02)	(74.46, 0.01)	(68.28, 0.04)	(76.84, 0.01)	50.0
19	(62.31, 0.11)	(52.73, 0.37)	(93.47, 0.0)	(46.61, 0.61)	(117.6, 0.0)	(60.83, 0.14)	(136.66, 0.0)	(75.28, 0.01)	(88.84, 0.0)	(96.01, 0.0)	50.0
20	(91.08, 0.0)	(126.32, 0.0)	(118.75, 0.0)	(90.96, 0.0)	(85.47, 0.0)	(91.01, 0.0)	(86.94, 0.0)	(93.59, 0.0)	(80.74, 0.0)	(79.47, 0.01)	50.0
21	(108.18, 0.0)	(130.64, 0.0)	(94.78, 0.0)	(80.13, 0.0)	(85.01, 0.0)	(66.4, 0.06)	(84.7, 0.0)	(105.86, 0.0)	(95.75, 0.0)	(99.19, 0.0)	50.0

Table 34. Batch3: χ^2 **statistic and p values to test the hypothesis that the observed ad delivery in different U.S. states is proportional to the population estimates provided by Facebook. In a majority of ads, the observed ad delivery is not proportional to the population estimates from Facebook. The Chi Square test was not able to be performed for the highlighted values.**

Ad ID	Solar Cells	Solar Cells (Copy)	Solar Cells + Contrarian Logo	Solar Cells + Advocacy Logo	Oil rigs	Oil rigs (Copy)	Oil rigs + Contrarian Logo	Oil rigs + Advocacy Logo	Controls	Controls (Copy)	df
1	(16.12, 0.0)	(9.14, 0.01)	(25.14, 0.0)	(23.77, 0.0)	(50.83, 0.0)	(88.08, 0.0)	(40.5, 0.0)	(39.07, 0.0)	(75.92, 0.0)	(87.77, 0.0)	2.0
2	(16.26, 0.0)	(3.78, 0.15)	(23.31, 0.0)	(38.66, 0.0)	(51.56, 0.0)	(58.89, 0.0)	(36.93, 0.0)	(44.47, 0.0)	(41.48, 0.0)	(41.88, 0.0)	2.0
3	(52.66, 0.0)	(30.63, 0.0)	(22.8, 0.0)	(2.86, 0.24)	(47.2, 0.0)	(42.7, 0.0)	(45.58, 0.0)	(3.24, 0.2)	(65.37, 0.0)	(65.76, 0.0)	2.0
4	(10.44, 0.01)	(2.9, 0.23)	(30.92, 0.0)	(16.03, 0.0)	(50.83, 0.0)	(42.58, 0.0)	(45.95, 0.0)	(74.85, 0.0)	(53.74, 0.0)	(79.24, 0.0)	2.0
5	(1.19, 0.55)	(49.32, 0.0)	(42.23, 0.0)	(53.52, 0.0)	(32.22, 0.0)	(43.06, 0.0)	(65.23, 0.0)	(53.24, 0.0)	(30.53, 0.0)	(56.01, 0.0)	2.0
6	(4.16, 0.12)	(12.13, 0.0)	(28.86, 0.0)	(30.81, 0.0)	(37.3, 0.0)	(62.94, 0.0)	(40.67, 0.0)	(60.41, 0.0)	(1.53, 0.47)	(3.64, 0.16)	2.0
7	(10.62, 0.0)	(6.41, 0.04)	(0.72, 0.7)	(0.74, 0.69)	(54.86, 0.0)	(67.38, 0.0)	(41.88, 0.0)	(88.93, 0.0)	(7.36, 0.03)	(10.93, 0.0)	2.0
8	(7.4, 0.02)	(3.78, 0.15)	(18.41, 0.0)	(2.33, 0.31)	(49.35, 0.0)	(49.09, 0.0)	(33.42, 0.0)	(56.85, 0.0)	(3.99, 0.14)	(6.35, 0.04)	2.0
9	(15.09, 0.0)	(7.28, 0.03)	(39.72, 0.0)	(9.25, 0.01)	(39.34, 0.0)	(30.29, 0.0)	(52.75, 0.0)	(56.22, 0.0)	(15.46, 0.0)	(16.45, 0.0)	2.0
10	(1.11, 0.57)	(6.9, 0.03)	(14.66, 0.0)	(23.27, 0.0)	(45.81, 0.0)	(43.08, 0.0)	(64.21, 0.0)	(22.19, 0.0)	(4.92, 0.09)	(0.73, 0.69)	2.0
11	(2.87, 0.24)	(2.33, 0.31)	(44.44, 0.0)	(8.53, 0.01)	(76.58, 0.0)	(71.44, 0.0)	(56.23, 0.0)	(72.08, 0.0)	(0.87, 0.65)	(1.39, 0.5)	2.0
12	(28.08, 0.0)	(25.09, 0.0)	(19.99, 0.0)	(5.91, 0.05)	(55.93, 0.0)	(20.08, 0.0)	(36.31, 0.0)	(74.86, 0.0)	(82.86, 0.0)	(58.39, 0.0)	2.0
13	(14.94, 0.0)	(24.7, 0.0)	(26.21, 0.0)	(35.05, 0.0)	(46.47, 0.0)	(51.3, 0.0)	(77.6, 0.0)	(81.78, 0.0)	(2.65, 0.27)	(2.21, 0.33)	2.0
14	(22.26, 0.0)	(1.62, 0.45)	(26.61, 0.0)	(3.17, 0.21)	(16.75, 0.0)	(28.12, 0.0)	(25.21, 0.0)	(21.38, 0.0)	(6.75, 0.03)	(5.92, 0.05)	2.0
15	(8.83, 0.01)	(11.26, 0.0)	(11.46, 0.0)	(4.67, 0.1)	(35.61, 0.0)	(42.25, 0.0)	(29.25, 0.0)	(48.21, 0.0)	(2.74, 0.25)	(7.94, 0.02)	2.0
16	(15.65, 0.0)	(15.55, 0.0)	(22.97, 0.0)	(17.2, 0.0)	(21.59, 0.0)	(10.91, 0.0)	(28.34, 0.0)	(72.67, 0.0)	(8.19, 0.02)	(2.16, 0.34)	2.0
17	(22.58, 0.0)	(48.87, 0.0)	(32.43, 0.0)	(23.99, 0.0)	(53.51, 0.0)	(46.78, 0.0)	(59.3, 0.0)	(56.97, 0.0)	(3.21, 0.2)	(0.75, 0.69)	2.0
18	(12.19, 0.0)	(6.63, 0.04)	(21.24, 0.0)	(15.05, 0.0)	(39.62, 0.0)	(60.54, 0.0)	(40.06, 0.0)	(66.24, 0.0)	(32.08, 0.0)	(28.26, 0.0)	2.0
19	(2.34, 0.31)	(7.41, 0.02)	(1.5, 0.47)	(1.68, 0.43)	(50.19, 0.0)	(39.69, 0.0)	(46.12, 0.0)	(86.43, 0.0)	(11.26, 0.0)	(4.6, 0.1)	2.0
20	(5.01, 0.08)	(0.16, 0.92)	(15.55, 0.0)	(9.31, 0.01)	(71.32, 0.0)	(65.09, 0.0)	(58.39, 0.0)	(69.39, 0.0)	(70.2, 0.0)	(78.02, 0.0)	2.0
21	(29.55, 0.0)	(16.22, 0.0)	(35.49, 0.0)	(8.66, 0.01)	(89.27, 0.0)	(63.42, 0.0)	(31.57, 0.0)	(61.9, 0.0)	(0.75, 0.69)	(1.08, 0.58)	2.0
22	(1.76, 0.41)	(2.67, 0.26)	(6.02, 0.05)	(0.81, 0.67)	(53.2, 0.0)	(64.18, 0.0)	(63.98, 0.0)	(93.0, 0.0)	(23.03, 0.0)	(30.34, 0.0)	2.0

Table 35. Batch1: χ^2 **statistic and p values to test the hypothesis that the observed ad delivery in different gender based ad destinations is proportional to the population estimates provided by Facebook. In a majority of ads, the observed ad delivery is not proportional to the population estimates from Facebook.**

Ad ID	Solar Cells	Solar Cells (Copy)	Solar Cells + Contrarian Logo	Solar Cells + Advocacy Logo	Oil rigs	Oil rigs (Copy)	Oil rigs + Contrarian Logo	Oil rigs + Advocacy Logo	Controls	Controls (Copy)	df
1	(13.15, 0.0)	(13.54, 0.0)	(19.51, 0.0)	(19.35, 0.0)	(43.08, 0.0)	(48.36, 0.0)	(36.02, 0.0)	(38.27, 0.0)	(23.12, 0.0)	(16.98, 0.0)	2.0
2	(6.36, 0.04)	(8.66, 0.01)	(13.02, 0.0)	(27.35, 0.0)	(41.96, 0.0)	(50.33, 0.0)	(20.44, 0.0)	(44.13, 0.0)	(43.32, 0.0)	(48.34, 0.0)	2.0
3	(0.1, 0.95)	(1.88, 0.39)	(12.98, 0.0)	(6.58, 0.04)	(28.94, 0.0)	(44.72, 0.0)	(34.86, 0.0)	(31.57, 0.0)	(4.15, 0.13)	(1.1, 0.58)	2.0
4	(4.15, 0.13)	(0.93, 0.63)	(7.71, 0.02)	(5.04, 0.08)	(35.49, 0.0)	(29.24, 0.0)	(39.93, 0.0)	(42.25, 0.0)	(3.67, 0.16)	(2.52, 0.28)	2.0
5	(1.8, 0.41)	(0.8, 0.67)	(5.29, 0.07)	(12.08, 0.0)	(45.68, 0.0)	(30.06, 0.0)	(29.74, 0.0)	(43.96, 0.0)	(13.22, 0.0)	(0.7, 0.71)	2.0
6	(5.02, 0.08)	(27.25, 0.0)	(15.24, 0.0)	(32.66, 0.0)	(46.2, 0.0)	(42.89, 0.0)	(29.24, 0.0)	(36.31, 0.0)	(15.63, 0.0)	(25.89, 0.0)	2.0
7	(0.62, 0.73)	(1.45, 0.48)	(1.24, 0.54)	(1.21, 0.55)	(46.9, 0.0)	(37.57, 0.0)	(32.17, 0.0)	(44.45, 0.0)	(5.46, 0.07)	(12.39, 0.0)	2.0
8	(11.68, 0.0)	(15.83, 0.0)	(21.01, 0.0)	(21.34, 0.0)	(19.35, 0.0)	(22.34, 0.0)	(29.8, 0.0)	(26.61, 0.0)	(21.14, 0.0)	(10.0, 0.01)	2.0
9	(7.75, 0.02)	(17.76, 0.0)	(16.68, 0.0)	(10.8, 0.0)	(32.24, 0.0)	(19.59, 0.0)	(42.23, 0.0)	(25.35, 0.0)	(0.62, 0.73)	(1.14, 0.57)	2.0
10	(8.57, 0.01)	(9.78, 0.01)	(6.82, 0.03)	(13.52, 0.0)	(44.89, 0.0)	(46.08, 0.0)	(45.04, 0.0)	(21.24, 0.0)	(22.64, 0.0)	(21.59, 0.0)	2.0
11	(23.07, 0.0)	(7.83, 0.02)	(25.72, 0.0)	(28.07, 0.0)	(32.81, 0.0)	(50.33, 0.0)	(31.83, 0.0)	(52.46, 0.0)	(42.25, 0.0)	(38.69, 0.0)	2.0
12	(0.8, 0.67)	(3.67, 0.16)	(4.64, 0.1)	(12.75, 0.0)	(68.25, 0.0)	(37.73, 0.0)	(61.95, 0.0)	(33.42, 0.0)	(1.07, 0.59)	(0.87, 0.65)	2.0
13	(23.55, 0.0)	(24.22, 0.0)	(19.3, 0.0)	(5.92, 0.05)	(52.15, 0.0)	(61.95, 0.0)	(51.31, 0.0)	(36.31, 0.0)	(0.71, 0.7)	(2.53, 0.28)	2.0
14	(20.27, 0.0)	(32.3, 0.0)	(30.63, 0.0)	(20.02, 0.0)	(40.1, 0.0)	(21.37, 0.0)	(6.7, 0.04)	(37.37, 0.0)	(12.74, 0.0)	(20.28, 0.0)	2.0
15	(3.43, 0.18)	(6.47, 0.04)	(4.18, 0.12)	(17.1, 0.0)	(45.04, 0.0)	(66.64, 0.0)	(55.17, 0.0)	(56.27, 0.0)	(62.28, 0.0)	(30.07, 0.0)	2.0
16	(6.52, 0.04)	(5.03, 0.08)	(8.97, 0.01)	(2.23, 0.33)	(53.74, 0.0)	(16.32, 0.0)	(35.9, 0.0)	(38.07, 0.0)	(11.8, 0.0)	(4.98, 0.08)	2.0
17	(15.63, 0.0)	(2.39, 0.3)	(20.27, 0.0)	(22.73, 0.0)	(69.74, 0.0)	(32.17, 0.0)	(33.42, 0.0)	(53.08, 0.0)	(2.95, 0.23)	(1.91, 0.39)	2.0
18	(20.76, 0.0)	(28.73, 0.0)	(1.18, 0.55)	(5.63, 0.06)	(51.64, 0.0)	(35.57, 0.0)	(46.63, 0.0)	(54.0, 0.0)	(17.65, 0.0)	(23.36, 0.0)	2.0
19	(15.91, 0.0)	(21.0, 0.0)	(15.65, 0.0)	(14.85, 0.0)	(18.43, 0.0)	(14.12, 0.0)	(20.72, 0.0)	(43.73, 0.0)	(5.02, 0.08)	(16.43, 0.0)	2.0
20	(7.69, 0.02)	(5.59, 0.06)	(4.6, 0.1)	(4.81, 0.09)	(27.4, 0.0)	(62.71, 0.0)	(22.96, 0.0)	(25.22, 0.0)	(37.73, 0.0)	(57.77, 0.0)	2.0
21	(5.0, 0.08)	(13.87, 0.0)	(2.66, 0.26)	(16.76, 0.0)	(72.81, 0.0)	(44.36, 0.0)	(50.15, 0.0)	(40.06, 0.0)	(10.89, 0.0)	(12.07, 0.0)	2.0
22	(13.27, 0.0)	(4.12, 0.13)	(2.05, 0.36)	(11.01, 0.0)	(31.11, 0.0)	(32.02, 0.0)	(17.05, 0.0)	(50.76, 0.0)	(25.42, 0.0)	(31.7, 0.0)	2.0

Table 36. Batch2: χ^2 **statistic and p values to test the hypothesis that the observed ad delivery in different gender based ad destinations is proportional to the population estimates provided by Facebook. In a majority of ads, the observed ad delivery is not proportional to the population estimates from Facebook.**

Ad ID	Solar Cells	Solar Cells (Copy)	Solar Cells + Contrarian Logo	Solar Cells + Advocacy Logo	Oil rigs	Oil rigs (Copy)	Oil rigs + Contrarian Logo	Oil rigs + Advocacy Logo	Controls	Controls (Copy)	df
1	(15.11, 0.0)	(8.34, 0.02)	(5.68, 0.06)	(4.1, 0.13)	(29.38, 0.0)	(41.0, 0.0)	(42.93, 0.0)	(18.44, 0.0)	(2.41, 0.3)	(0.92, 0.63)	2.0
2	(2.01, 0.37)	(2.02, 0.36)	(21.01, 0.0)	(18.57, 0.0)	(26.88, 0.0)	(15.92, 0.0)	(27.84, 0.0)	(50.68, 0.0)	(26.17, 0.0)	(18.83, 0.0)	2.0
3	(5.55, 0.06)	(12.94, 0.0)	(13.95, 0.0)	(7.4, 0.02)	(20.01, 0.0)	(18.17, 0.0)	(52.4, 0.0)	(39.28, 0.0)	(2.21, 0.33)	(8.07, 0.02)	2.0
4	(15.85, 0.0)	(18.57, 0.0)	(0.65, 0.72)	(10.15, 0.01)	(38.34, 0.0)	(12.01, 0.0)	(20.09, 0.0)	(47.73, 0.0)	(2.43, 0.3)	(0.65, 0.72)	2.0
5	(17.18, 0.0)	(13.51, 0.0)	(10.62, 0.0)	(2.85, 0.24)	(39.81, 0.0)	(37.08, 0.0)	(34.45, 0.0)	(27.29, 0.0)	(4.12, 0.13)	(10.49, 0.01)	2.0
6	(11.92, 0.0)	(5.46, 0.07)	(1.18, 0.55)	(2.02, 0.36)	(23.58, 0.0)	(19.89, 0.0)	(37.07, 0.0)	(47.22, 0.0)	(0.57, 0.75)	(0.56, 0.76)	2.0
7	(23.16, 0.0)	(13.4, 0.0)	(10.06, 0.01)	(15.85, 0.0)	(47.08, 0.0)	(40.41, 0.0)	(37.42, 0.0)	(29.76, 0.0)	(33.42, 0.0)	(76.46, 0.0)	2.0
8	(22.49, 0.0)	(18.74, 0.0)	(16.61, 0.0)	(9.19, 0.01)	(20.42, 0.0)	(27.88, 0.0)	(32.22, 0.0)	(28.91, 0.0)	(19.93, 0.0)	(7.18, 0.03)	2.0
9	(16.6, 0.0)	(25.17, 0.0)	(0.47, 0.79)	(2.94, 0.23)	(19.87, 0.0)	(53.24, 0.0)	(26.0, 0.0)	(25.1, 0.0)	(96.59, 0.0)	(81.96, 0.0)	2.0
10	(13.96, 0.0)	(3.0, 0.22)	(20.16, 0.0)	(7.28, 0.0)	(40.41, 0.0)	(37.58, 0.0)	(37.48, 0.0)	(42.85, 0.0)	(32.39, 0.0)	(31.47, 0.0)	2.0
11	(18.34, 0.0)	(0.11, 0.95)	(15.45, 0.0)	(12.82, 0.0)	(12.98, 0.0)	(47.29, 0.0)	(24.14, 0.0)	(33.38, 0.0)	(2.13, 0.34)	(0.53, 0.77)	2.0
12	(12.82, 0.0)	(17.18, 0.0)	(3.22, 0.2)	(8.05, 0.02)	(13.96, 0.0)	(17.61, 0.0)	(31.9, 0.0)	(36.31, 0.0)	(8.49, 0.01)	(3.65, 0.16)	2.0
13	(0.24, 0.89)	(1.25, 0.53)	(8.18, 0.02)	(2.96, 0.23)	(32.48, 0.0)	(38.63, 0.0)	(52.15, 0.0)	(42.56, 0.0)	(2.66, 0.26)	(1.07, 0.59)	2.0
14	(7.8, 0.02)	(6.87, 0.03)	(1.63, 0.44)	(3.64, 0.16)	(41.26, 0.0)	(36.21, 0.0)	(35.72, 0.0)	(20.82, 0.0)	(2.05, 0.36)	(0.73, 0.69)	2.0
15	(10.7, 0.0)	(5.47, 0.06)	(28.86, 0.0)	(6.97, 0.03)	(23.88, 0.0)	(23.17, 0.0)	(39.34, 0.0)	(15.25, 0.0)	(8.76, 0.01)	(16.17, 0.0)	2.0
16	(10.62, 0.0)	(11.17, 0.0)	(24.14, 0.0)	(15.55, 0.0)	(49.94, 0.0)	(30.71, 0.0)	(26.25, 0.0)	(23.72, 0.0)	(1.79, 0.41)	(2.11, 0.35)	2.0
17	(3.77, 0.15)	(3.02, 0.22)	(18.22, 0.0)	(2.45, 0.29)	(29.88, 0.0)	(27.83, 0.0)	(37.54, 0.0)	(30.83, 0.0)	(3.54, 0.17)	(9.17, 0.01)	2.0
18	(11.64, 0.0)	(7.98, 0.02)	(18.26, 0.0)	(4.55, 0.1)	(31.57, 0.0)	(45.95, 0.0)	(28.75, 0.0)	(17.71, 0.0)	(42.25, 0.0)	(37.21, 0.0)	2.0
19	(12.48, 0.0)	(8.18, 0.02)	(1.8, 0.41)	(11.73, 0.0)	(30.6, 0.0)	(43.29, 0.0)	(39.0, 0.0)	(18.53, 0.0)	(1.63, 0.44)	(1.08, 0.58)	2.0
20	(3.42, 0.18)	(5.09, 0.08)	(3.25, 0.2)	(8.02, 0.02)	(59.64, 0.0)	(40.24, 0.0)	(51.62, 0.0)	(32.48, 0.0)	(42.12, 0.0)	(52.65, 0.0)	2.0
21	(7.76, 0.02)	(15.83, 0.0)	(8.25, 0.02)	(20.84, 0.0)	(26.87, 0.0)	(42.25, 0.0)	(33.14, 0.0)	(62.08, 0.0)	(32.65, 0.0)	(44.65, 0.0)	2.0

Table 37. Batch3: χ^2 **statistic and p values to test the hypothesis that the observed ad delivery in different gender based ad destinations is proportional to the population estimates provided by Facebook. In a majority of ads, the observed ad delivery is not proportional to the population estimates from Facebook.**

Table 38. Batch1: χ^2 statistic and p values to test the hypothesis that the observed ad delivery in different age based ad destinations is proportional to the population estimates provided by Facebook. In a majority of ads, the observed ad delivery is not proportional to the population estimates from Facebook.

Ad ID	Solar Cells	Solar Cells (Copy)	Solar Cells + Contrarian Logo	Solar Cells + Advocacy Logo	Oil rigs	Oil rigs (Copy)	Oil rigs + Contrarian Logo	Oil rigs + Advocacy Logo	Controls	Controls (Copy)	df
1	(302.51, 0.0)	(385.41, 0.0)	(369.35, 0.0)	(294.82, 0.0)	(205.49, 0.0)	(233.23, 0.0)	(234.73, 0.0)	(289.0, 0.0)	(463.34, 0.0)	(417.05, 0.0)	5.0
2	(301.61, 0.0)	(282.14, 0.0)	(277.93, 0.0)	(381.29, 0.0)	(339.91, 0.0)	(341.34, 0.0)	(421.03, 0.0)	(362.77, 0.0)	(187.0, 0.0)	(312.64, 0.0)	5.0
3	(166.25, 0.0)	(255.77, 0.0)	(296.22, 0.0)	(296.22, 0.0)	(264.97, 0.0)	(225.35, 0.0)	(270.68, 0.0)	(353.26, 0.0)	(355.09, 0.0)	(381.51, 0.0)	5.0
4	(364.75, 0.0)	(426.58, 0.0)	(394.32, 0.0)	(321.63, 0.0)	(412.74, 0.0)	(290.78, 0.0)	(357.23, 0.0)	(388.61, 0.0)	(120.63, 0.0)	(135.6, 0.0)	5.0
5	(425.98, 0.0)	(243.8, 0.0)	(161.96, 0.0)	(332.67, 0.0)	(375.14, 0.0)	(403.02, 0.0)	(398.8, 0.0)	(558.47, 0.0)	(318.63, 0.0)	(307.82, 0.0)	5.0
6	(304.33, 0.0)	(246.75, 0.0)	(205.39, 0.0)	(286.74, 0.0)	(288.23, 0.0)	(432.48, 0.0)	(431.28, 0.0)	(362.94, 0.0)	(333.75, 0.0)	(322.45, 0.0)	5.0
7	(442.47, 0.0)	(378.23, 0.0)	(333.58, 0.0)	(599.85, 0.0)	(206.75, 0.0)	(265.03, 0.0)	(396.46, 0.0)	(227.15, 0.0)	(350.31, 0.0)	(369.44, 0.0)	5.0
8	(430.26, 0.0)	(360.6, 0.0)	(421.0, 0.0)	(379.51, 0.0)	(319.55, 0.0)	(287.94, 0.0)	(212.48, 0.0)	(247.41, 0.0)	(385.89, 0.0)	(404.44, 0.0)	5.0
9	(245.63, 0.0)	(267.54, 0.0)	(212.99, 0.0)	(449.16, 0.0)	(284.62, 0.0)	(343.23, 0.0)	(370.28, 0.0)	(336.25, 0.0)	(231.4, 0.0)	(276.03, 0.0)	5.0
10	(363.57, 0.0)	(357.38, 0.0)	(279.11, 0.0)	(357.89, 0.0)	(463.32, 0.0)	(482.42, 0.0)	(336.6, 0.0)	(489.62, 0.0)	(293.96, 0.0)	(359.55, 0.0)	5.0
11	(341.33, 0.0)	(315.76, 0.0)	(236.36, 0.0)	(375.15, 0.0)	(475.94, 0.0)	(335.32, 0.0)	(404.95, 0.0)	(475.71, 0.0)	(201.3, 0.0)	(240.13, 0.0)	5.0
12	(144.08, 0.0)	(147.04, 0.0)	(55.71, 0.0)	(268.9, 0.0)	(335.24, 0.0)	(302.92, 0.0)	(231.59, 0.0)	(419.68, 0.0)	(277.81, 0.0)	(207.62, 0.0)	5.0
13	(241.98, 0.0)	(282.95, 0.0)	(201.61, 0.0)	(478.99, 0.0)	(345.43, 0.0)	(392.46, 0.0)	(242.41, 0.0)	(355.85, 0.0)	(318.22, 0.0)	(310.22, 0.0)	5.0
14	(354.13, 0.0)	(399.64, 0.0)	(278.52, 0.0)	(453.76, 0.0)	(280.75, 0.0)	(302.37, 0.0)	(330.82, 0.0)	(328.58, 0.0)	(355.09, 0.0)	(286.91, 0.0)	5.0
15	(404.76, 0.0)	(474.57, 0.0)	(275.91, 0.0)	(460.24, 0.0)	(348.76, 0.0)	(349.85, 0.0)	(387.33, 0.0)	(275.88, 0.0)	(329.08, 0.0)	(308.53, 0.0)	5.0
16	(370.94, 0.0)	(282.51, 0.0)	(269.82, 0.0)	(452.03, 0.0)	(374.04, 0.0)	(339.74, 0.0)	(321.55, 0.0)	(289.84, 0.0)	(420.82, 0.0)	(326.29, 0.0)	5.0
17	(412.24, 0.0)	(292.65, 0.0)	(227.68, 0.0)	(283.6, 0.0)	(363.34, 0.0)	(365.32, 0.0)	(425.82, 0.0)	(418.92, 0.0)	(159.56, 0.0)	(133.34, 0.0)	5.0
18	(357.67, 0.0)	(251.11, 0.0)	(181.95, 0.0)	(288.47, 0.0)	(189.9, 0.0)	(281.19, 0.0)	(161.1, 0.0)	(294.71, 0.0)	(417.72, 0.0)	(488.35, 0.0)	5.0
19	(519.54, 0.0)	(506.76, 0.0)	(298.38, 0.0)	(314.85, 0.0)	(223.94, 0.0)	(243.3, 0.0)	(322.27, 0.0)	(417.26, 0.0)	(163.83, 0.0)	(182.85, 0.0)	5.0
20	(282.22, 0.0)	(332.25, 0.0)	(339.77, 0.0)	(334.1, 0.0)	(294.91, 0.0)	(232.2, 0.0)	(333.32, 0.0)	(409.62, 0.0)	(308.75, 0.0)	(304.12, 0.0)	5.0
21	(330.17, 0.0)	(394.24, 0.0)	(139.97, 0.0)	(348.03, 0.0)	(349.87, 0.0)	(217.6, 0.0)	(331.03, 0.0)	(181.07, 0.0)	(254.78, 0.0)	(295.49, 0.0)	5.0
22	(348.37, 0.0)	(191.77, 0.0)	(226.59, 0.0)	(307.12, 0.0)	(353.62, 0.0)	(258.88, 0.0)	(312.89, 0.0)	(385.93, 0.0)	(105.25, 0.0)	(86.11, 0.0)	5.0

Table 39. Batch2: χ^2 statistic and p values to test the hypothesis that the observed ad delivery in different age based ad destinations is proportional to the population estimates provided by Facebook. In a majority of ads, the observed ad delivery is not proportional to the population estimates from Facebook.

Ad ID	Solar Cells	Solar Cells (Copy)	Solar Cells + Contrarian Logo	Solar Cells + Advocacy Logo	Oil rigs	Oil rigs (Copy)	Oil rigs + Contrarian Logo	Oil rigs + Advocacy Logo	Controls	Controls (Copy)	df
1	(240.66, 0.0)	(264.51, 0.0)	(350.49, 0.0)	(323.42, 0.0)	(337.91, 0.0)	(555.35, 0.0)	(461.74, 0.0)	(261.57, 0.0)	(360.69, 0.0)	(360.18, 0.0)	5.0
2	(415.28, 0.0)	(400.2, 0.0)	(436.58, 0.0)	(420.91, 0.0)	(369.26, 0.0)	(409.56, 0.0)	(384.11, 0.0)	(400.43, 0.0)	(294.99, 0.0)	(308.44, 0.0)	5.0
3	(404.84, 0.0)	(315.4, 0.0)	(232.59, 0.0)	(306.24, 0.0)	(426.16, 0.0)	(469.0, 0.0)	(319.51, 0.0)	(434.67, 0.0)	(273.88, 0.0)	(323.4, 0.0)	5.0
4	(414.86, 0.0)	(547.21, 0.0)	(328.6, 0.0)	(506.07, 0.0)	(356.52, 0.0)	(356.09, 0.0)	(353.92, 0.0)	(372.42, 0.0)	(374.36, 0.0)	(359.82, 0.0)	5.0
5	(365.52, 0.0)	(419.78, 0.0)	(406.02, 0.0)	(408.53, 0.0)	(488.13, 0.0)	(431.04, 0.0)	(458.54, 0.0)	(403.56, 0.0)	(330.86, 0.0)	(350.85, 0.0)	5.0
6	(489.75, 0.0)	(332.99, 0.0)	(356.26, 0.0)	(324.06, 0.0)	(470.71, 0.0)	(365.23, 0.0)	(422.13, 0.0)	(385.0, 0.0)	(393.81, 0.0)	(285.07, 0.0)	5.0
7	(432.63, 0.0)	(384.93, 0.0)	(315.52, 0.0)	(438.9, 0.0)	(260.67, 0.0)	(412.63, 0.0)	(314.84, 0.0)	(474.65, 0.0)	(329.19, 0.0)	(495.3, 0.0)	5.0
8	(211.03, 0.0)	(332.04, 0.0)	(339.74, 0.0)	(415.89, 0.0)	(354.98, 0.0)	(403.07, 0.0)	(343.7, 0.0)	(487.06, 0.0)	(391.13, 0.0)	(407.68, 0.0)	5.0
9	(314.9, 0.0)	(201.05, 0.0)	(379.61, 0.0)	(412.39, 0.0)	(366.69, 0.0)	(360.67, 0.0)	(312.42, 0.0)	(451.65, 0.0)	(318.41, 0.0)	(399.02, 0.0)	5.0
10	(396.9, 0.0)	(480.14, 0.0)	(552.1, 0.0)	(365.92, 0.0)	(418.11, 0.0)	(407.0, 0.0)	(396.09, 0.0)	(445.16, 0.0)	(364.76, 0.0)	(395.97, 0.0)	5.0
11	(368.89, 0.0)	(471.84, 0.0)	(409.81, 0.0)	(402.1, 0.0)	(377.42, 0.0)	(465.99, 0.0)	(427.14, 0.0)	(442.5, 0.0)	(376.81, 0.0)	(398.4, 0.0)	5.0
12	(416.23, 0.0)	(404.96, 0.0)	(437.94, 0.0)	(519.32, 0.0)	(406.97, 0.0)	(378.15, 0.0)	(434.89, 0.0)	(330.76, 0.0)	(414.12, 0.0)	(557.19, 0.0)	5.0
13	(336.55, 0.0)	(322.36, 0.0)	(412.29, 0.0)	(415.35, 0.0)	(423.83, 0.0)	(415.47, 0.0)	(285.06, 0.0)	(436.22, 0.0)	(346.21, 0.0)	(430.66, 0.0)	5.0
14	(359.34, 0.0)	(324.33, 0.0)	(329.79, 0.0)	(346.03, 0.0)	(340.7, 0.0)	(322.75, 0.0)	(282.52, 0.0)	(334.25, 0.0)	(338.0, 0.0)	(420.29, 0.0)	5.0
15	(295.33, 0.0)	(387.94, 0.0)	(504.13, 0.0)	(394.17, 0.0)	(364.65, 0.0)	(435.43, 0.0)	(309.52, 0.0)	(379.58, 0.0)	(387.64, 0.0)	(390.2, 0.0)	5.0
16	(327.19, 0.0)	(359.88, 0.0)	(425.26, 0.0)	(433.55, 0.0)	(425.44, 0.0)	(471.97, 0.0)	(427.99, 0.0)	(460.84, 0.0)	(358.2, 0.0)	(359.79, 0.0)	5.0
17	(374.68, 0.0)	(369.65, 0.0)	(398.02, 0.0)	(501.06, 0.0)	(609.47, 0.0)	(400.75, 0.0)	(494.88, 0.0)	(440.04, 0.0)	(435.27, 0.0)	(353.39, 0.0)	5.0
18	(319.14, 0.0)	(309.92, 0.0)	(359.35, 0.0)	(519.02, 0.0)	(299.78, 0.0)	(382.94, 0.0)	(391.96, 0.0)	(481.99, 0.0)	(398.34, 0.0)	(384.75, 0.0)	5.0
19	(359.61, 0.0)	(467.86, 0.0)	(346.51, 0.0)	(397.74, 0.0)	(388.51, 0.0)	(501.11, 0.0)	(525.51, 0.0)	(563.1, 0.0)	(324.68, 0.0)	(328.59, 0.0)	5.0
20	(476.38, 0.0)	(397.95, 0.0)	(378.06, 0.0)	(400.8, 0.0)	(441.96, 0.0)	(463.14, 0.0)	(489.42, 0.0)	(496.54, 0.0)	(347.52, 0.0)	(357.86, 0.0)	5.0
21	(340.65, 0.0)	(419.51, 0.0)	(478.39, 0.0)	(444.12, 0.0)	(511.78, 0.0)	(400.6, 0.0)	(341.76, 0.0)	(434.09, 0.0)	(363.68, 0.0)	(314.35, 0.0)	5.0
22	(463.49, 0.0)	(297.57, 0.0)	(407.21, 0.0)	(442.11, 0.0)	(339.03, 0.0)	(432.22, 0.0)	(359.29, 0.0)	(533.67, 0.0)	(342.47, 0.0)	(467.64, 0.0)	5.0

Table 40. Batch3: χ^2 statistic and p values to test the hypothesis that the observed ad delivery in different age based ad destinations is proportional to the population estimates provided by Facebook. In a majority of ads, the observed ad delivery is not proportional to the population estimates from Facebook.

Ad ID	Solar Cells	Solar Cells (Copy)	Solar Cells + Contrarian Logo	Solar Cells + Advocacy Logo	Oil rigs	Oil rigs (Copy)	Oil rigs + Contrarian Logo	Oil rigs + Advocacy Logo	Controls	Controls (Copy)	df
1	(253.28, 0.0)	(237.93, 0.0)	(257.05, 0.0)	(410.96, 0.0)	(401.91, 0.0)	(360.31, 0.0)	(296.15, 0.0)	(328.25, 0.0)	(372.85, 0.0)	(392.32, 0.0)	5.0
2	(441.44, 0.0)	(375.16, 0.0)	(232.82, 0.0)	(314.09, 0.0)	(412.43, 0.0)	(348.91, 0.0)	(330.51, 0.0)	(441.48, 0.0)	(340.34, 0.0)	(390.5, 0.0)	5.0
3	(251.24, 0.0)	(268.49, 0.0)	(269.96, 0.0)	(298.99, 0.0)	(197.26, 0.0)	(363.22, 0.0)	(239.99, 0.0)	(329.79, 0.0)	(352.6, 0.0)	(379.0, 0.0)	5.0
4	(259.29, 0.0)	(271.41, 0.0)	(252.32, 0.0)	(342.74, 0.0)	(353.05, 0.0)	(330.0, 0.0)	(308.8, 0.0)	(349.5, 0.0)	(413.49, 0.0)	(406.07, 0.0)	5.0
5	(386.55, 0.0)	(380.63, 0.0)	(339.54, 0.0)	(395.81, 0.0)	(350.5, 0.0)	(338.25, 0.0)	(357.79, 0.0)	(334.68, 0.0)	(434.17, 0.0)	(365.28, 0.0)	5.0
6	(203.4, 0.0)	(262.52, 0.0)	(262.56, 0.0)	(273.75, 0.0)	(346.04, 0.0)	(287.88, 0.0)	(369.62, 0.0)	(378.96, 0.0)	(310.31, 0.0)	(339.41, 0.0)	5.0
7	(304.04, 0.0)	(222.57, 0.0)	(215.38, 0.0)	(278.87, 0.0)	(343.1, 0.0)	(390.82, 0.0)	(240.37, 0.0)	(341.34, 0.0)	(204.08, 0.0)	(252.15, 0.0)	5.0
8	(252.87, 0.0)	(312.8, 0.0)	(276.86, 0.0)	(369.99, 0.0)	(348.62, 0.0)	(376.37, 0.0)	(233.06, 0.0)	(346.53, 0.0)	(297.64, 0.0)	(304.85, 0.0)	5.0
9	(277.78, 0.0)	(310.07, 0.0)	(360.29, 0.0)	(362.94, 0.0)	(323.56, 0.0)	(290.05, 0.0)	(291.7, 0.0)	(308.02, 0.0)	(219.66, 0.0)	(247.69, 0.0)	5.0
10	(313.84, 0.0)	(489.51, 0.0)	(247.21, 0.0)	(383.54, 0.0)	(210.4, 0.0)	(321.68, 0.0)	(201.07, 0.0)	(353.41, 0.0)	(250.04, 0.0)	(259.75, 0.0)	5.0
11	(295.57, 0.0)	(367.21, 0.0)	(301.12, 0.0)	(346.91, 0.0)	(318.6, 0.0)	(343.32, 0.0)	(194.6, 0.0)	(293.48, 0.0)	(361.54, 0.0)	(366.6, 0.0)	5.0
12	(282.94, 0.0)	(309.55, 0.0)	(313.07, 0.0)	(401.81, 0.0)	(342.97, 0.0)	(411.61, 0.0)	(252.58, 0.0)	(371.43, 0.0)	(328.99, 0.0)	(294.08, 0.0)	5.0
13	(387.32, 0.0)	(335.41, 0.0)	(347.62, 0.0)	(332.63, 0.0)	(359.76, 0.0)	(339.42, 0.0)	(304.9, 0.0)	(389.55, 0.0)	(267.69, 0.0)		5.0
14	(285.8, 0.0)	(361.84, 0.0)	(289.23, 0.0)	(373.78, 0.0)	(299.52, 0.0)	(201.56, 0.0)	(387.61, 0.0)	(254.25, 0.0)	(314.79, 0.0)	(300.0, 0.0)	5.0
15	(343.33, 0.0)	(219.31, 0.0)	(211.65, 0.0)	(333.45, 0.0)	(229.25, 0.0)	(216.21, 0.0)	(221.94, 0.0)	(314.36, 0.0)	(360.07, 0.0)	(263.1, 0.0)	5.0
16	(238.9, 0.0)	(261.31, 0.0)	(220.22, 0.0)	(232.16, 0.0)	(224.09, 0.0)	(313.06, 0.0)	(285.35, 0.0)	(241.99, 0.0)	(312.41, 0.0)	(244.19, 0.0)	5.0
17	(363.2, 0.0)	(302.95, 0.0)	(246.09, 0.0)	(316.5, 0.0)	(277.05, 0.0)	(248.77, 0.0)	(230.11, 0.0)	(308.77, 0.0)	(259.78, 0.0)	(411.23, 0.0)	5.0
18	(452.7, 0.0)	(445.95, 0.0)	(411.74, 0.0)	(397.19, 0.0)	(352.02, 0.0)	(407.03, 0.0)	(298.23, 0.0)	(285.33, 0.0)	(286.37, 0.0)	(299.62, 0.0)	5.0
19	(261.09, 0.0)	(270.92, 0.0)	(288.69, 0.0)	(262.53, 0.0)	(348.25, 0.0)	(354.32, 0.0)	(310.8, 0.0)	(224.69, 0.0)	(362.8, 0.0)	(334.55, 0.0)	5.0
20	(348.0, 0.0)	(472.12, 0.0)	(285.83, 0.0)	(288.63, 0.0)	(380.67, 0.0)	(219.06, 0.0)	(220.82, 0.0)	(345.33, 0.0)	(270.62, 0.0)	(384.15, 0.0)	5.0
21	(352.55, 0.0)	(287.36, 0.0)	(349.64, 0.0)	(350.32, 0.0)	(227.33, 0.0)	(324.19, 0.0)	(336.45, 0.0)	(337.68, 0.0)	(471.93, 0.0)	(318.36, 0.0)	5.0

State	Estimated Audience Size (Lower Bound)	Estimated Audience Size (Upper Bound)
Alabama	3400000	4000000
Alaska	530500	624100
Arizona	4900000	5800000
Arkansas	2000000	2400000
California	27200000	32000000
Colorado	3800000	4400000
Connecticut	2400000	2800000
Delaware	644900	758700
Florida	16500000	19400000
Georgia	7500000	8900000
Hawaii	978900	1200000
Idaho	1200000	1400000
Illinois	8200000	9600000
Indiana	4400000	5200000
Iowa	2000000	2300000
Kansas	1900000	2300000
Kentucky	3000000	3500000
Louisiana	3200000	3700000
Maine	889400	1000000
Maryland	4100000	4800000
Massachusetts	4700000	5600000
Michigan	6300000	7500000
Minnesota	3400000	4100000
Mississippi	1900000	2300000
Missouri	3900000	4600000
Montana	656300	772100
Nebraska	1200000	1500000
Nevada	2300000	2700000
New Hampshire	895800	1100000
New Jersey	6200000	7300000
New Mexico	1200000	1400000
New York	13800000	16300000
North Carolina	7300000	8600000
North Dakota	493100	580100
Ohio	7500000	8800000
Oklahoma	2700000	3200000
Oregon	2700000	3200000
Pennsylvania	8000000	9400000
Rhode Island	761100	895400
South Carolina	3500000	4200000
South Dakota	548100	644900
Tennessee	4800000	5600000
Texas	21300000	25100000
Utah	2200000	2500000
Vermont	392800	462100
Virginia	5800000	6900000
Washington D. C.	694200	816700
Washington	4800000	5700000
West Virginia	1100000	1300000
Wisconsin	3700000	4300000
Wyoming	350300	412100

Table 41. Estimated Facebook ad audience size estimates for different U.S. states

Gender	Estimated Audience Size (Lower Bound)	Estimated Audience Size (Upper Bound)
male	100725600	118361400
female	121112000	142313900
unknown	1997800	3190900

Table 42. Estimated Facebook ad audience size estimates for different genders

Ages	Estimated Audience Size (Lower Bound)	Estimated Audience Size (Upper Bound)
18-24	42538900	50135000
25-34	55250800	65054000
35-44	42453300	50032600
45-54	31922400	37540100
55-64	26205100	30632600
65+	26166800	30603100

Table 43. Estimated Facebook ad audience size estimates for different age groups