

Online Advertising in Ukraine and Russia During the 2022 Russian Invasion

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ABSTRACT

Online ads are a major source of information on the web. The mass reach of online advertising is often leveraged for information dissemination, at times with an objective to influence public opinion (e.g., election misinformation). We hypothesized that online advertising, due to its reach and potential, might have been used to spread information around the 2022 Russian invasion of Ukraine. Thus, to understand the online ad ecosystem during this conflict, we conducted a five-month long large-scale measurement study of online advertising in Ukraine, Russia, and the US. We studied advertising trends of ad platforms that delivered ads in Ukraine, Russia, and the US and conducted an in-depth qualitative analysis of the conflict-related ad content. We found that prominent US-based advertisers continued to support Russian websites, and a portion of online ads were used to spread conflict-related information, including protesting the invasion, and spreading awareness, which might have otherwise potentially been censored in Russia.

1 INTRODUCTION

Online ads are embedded on a large number of websites (e.g., news and social media): they financially support these sites, and they make up a significant fraction of the information that many web users are exposed to as they browse the web. In addition to the traditional function of ads to market products and services, online advertising enables targeted, mass dissemination of content that may be useful (e.g., COVID-19 vaccine awareness [6]), harmful (e.g., misleading clickbait [54], or outright misinformation [39] during the US elections). In this paper, we investigate the role of the online ad ecosystem during the 2022 Russian invasion of Ukraine.

Helping to motivate our investigation, we observed initial anecdotes that emerged about online advertising in the context of the invasion [41, 45, 50, 51]. On the one hand, in part to curb the spread of false information, prominent advertising and social media platforms, such as Google and Meta (Facebook), suspended their advertising services in Russia and barred Russian entities from advertising on their platforms [36–38, 40, 50], though implementing such suspensions effectively has proven challenging [11, 45, 51].

At the same time, various humanitarian groups, non-profit organizations, and for-profit brands have leveraged online advertising to spread information (e.g., aiming to bypass Russian censorship [43]) or support humanitarian efforts (e.g., seeking donations for Ukraine [7, 32]) [41].

To systematically study the role of the online advertising ecosystem during the invasion, we conducted a large-scale measurement study during March through August of 2022. Specifically, we used commercial proxies with endpoints in Ukraine, Russia, and the US to collect ads and their associated metadata (e.g., ad serving URLs and landing pages of ads) on 500 popular news websites over five months.

We used our resulting dataset to investigate two sets of questions. First, we considered the ad ecosystem as a whole. Specifically, we analyzed network requests to understand which ad platforms are (or are not) delivering ads to users in Ukraine and Russia.

Second, we considered the user-facing content of these ads. Specifically, we investigated the conflict-related information that reached people in Ukraine and Russia through online ads. To identify conflict-related ads for deeper analysis, we clustered collected ads using the unsupervised BERTopic clustering algorithm [46], and then manually investigated the clusters that contain ads with conflict-related content (e.g., war, conflict, special operation, donation, etc.). Among our findings:

- (1) Prominent US-based advertisers continued to support Russian websites, seemingly at odds with statements that claimed to suspend services.
- (2) Entities such as Ukrainian government agencies placed advertisements in Russia that raised awareness and protested the invasion. These campaigns contained information that may otherwise have been censored by Russia.
- (3) Clickbait advertisements exploited the ongoing conflict to attract clicks and generate ad revenue. Campaigns used sensational or alarming language with claims that may have spread misinformation.

Positionality statement. Since this paper is related to the Russian invasion of Ukraine, some results may require subjective interpretation. We thus provide a positionality statement. All of the researchers believe that Russia has invaded Ukraine. One author is from Kyiv, Ukraine. All of the authors currently live in the United States. We apply this positionality in contextualizing our results, e.g., our interpretation of what and why some ads are “conflict-related”. Our methods and results are scientific and readers with different positions can provide their own interpretations to our results.

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2 METHODOLOGY

In this section, we describe our methodology. We discuss ethical considerations in Section 5.

2.1 Ad Data Collection

2.1.1 Collecting ads. We extended OpenWPM [44], an open-source web measurement tool to capture ad images and their landing page URLs. To capture ad images, we parsed the DOM of the webpage, identified HTML elements that contain ads using EasyList [9], and took screenshots of those elements. We extended the coverage of EasyList by also taking screenshots of `iframe` elements, which often host advertisements, because it is known to be incomplete [42, 47, 52]. To capture landing page URLs, we simulated ad clicks. Simulating ad clicks involves extracting URLs from anchor tags of ad elements and resolving those URLs to their final destination.

2.1.2 Website selection. We collected ads on popular news websites in Ukraine, Russia, and the rest of the world. We relied on news websites because they commonly embed ads to generate revenue. We extracted popular news websites in Ukraine and Russia from Google Trends [13]. Specifically, we built a Selenium [26] based web crawler to extract *related news* links for the top 20 daily trending search key words in Ukraine and Russia from March 2nd 2022 to March 8th 2022. In total, we extracted 823 unique related news links (234 unique websites, i.e., eTLD+1's) that are popular on Google Trends in Ukraine, and 967 unique related news links (249 unique websites) for Russia. We further removed duplicates, i.e., we only considered one instance of a website that appeared in both countries, and capped the unique websites to 150 for both Ukraine and Russia. In our selected set of websites, 61 sites were popular in both Ukraine and Russia. For global news websites, we selected top-200 non-duplicate websites from the news website list released by Zeng et al. [54]. In total, we selected 500 popular news websites in Ukraine, Russia, and the rest of the world.

Website origin. Out of the 500 popular news websites, 77 originated from Ukraine, 212 from Russia, 158 from the United States, and 53 from other countries. We determined the origin country of websites based on top-level domains (e.g., .ua for Ukrainian websites), registrar, and registrant information (e.g., Ukrainian registrar/registant), and the language meta tag in the DOM object.

2.1.3 Simulating crawls from Ukraine, Russia, and the US. We relied on ISP-provided IP proxies from Bright Data [5] to simulate crawls from Ukraine, Russia, and the US. We chose capital cities of each country i.e., Kyiv, Moscow, and D.C. as representative locations. Note that we did not use residential IPs to avoid any inconvenience or risks to people using those IPs. We configured OpenWPM instances with proxies inside Ukraine, Russia, and the US before collecting ads. In addition, we changed the browser language to Ukrainian, Russian, and English for respective crawls. Since web requests are proxied and may take slightly longer to resolve, we set the page load timeout to 3 minutes and waited an additional 30 seconds before collecting the ads on each website.

2.1.4 Crawling frequency & data availability. Our data collection took place over two periods: we started collecting ads on March 9, 2022 in Ukraine, Russia, and the US. We collected ads once per day

through May 9, 2022. Starting on June 24, 2022, we collected ads on a weekly basis. In this paper, we report on data collected through August 19, 2022.¹ We will make our data available upon request.

2.2 Ad Content Analysis

2.2.1 Deduplication and text extraction from ads. Since ads typically contain text, we created a textual representation of ad images to analyze them at scale. We first deduplicated ad images based on the average image hash [17]. Average image hashing is agnostic to minor changes in size, aspect ratio, and coloring differences (contrast, brightness, etc.) and produces the same hash for nearly identical images. We then used optical character recognition (OCR) to extract text from each unique ad. Since the ads may contain text in Ukrainian, Russian, English, or other languages, we relied on Tesseract OCR engine [29] because of its ability to extract text in multiple languages from the same image. Finally, we translated the extracted text to English using the Google Translation API [12]. We also relied on the regional context and language expertise of one of the co-authors, who is fluent in Ukrainian and Russian, to improve translations.

2.2.2 Clustering ads. In total, we collected 225,749 unique ads across Ukraine, Russia, and the US. To help us identify conflict-related content within those ads, we used BERTopic² [46] to group ads with similar text into clusters. This allowed us to qualitatively analyze clusters and to isolate specific clusters for in-depth manual analysis of advertisements. Prior studies have also used topic modeling to analyze large amounts of advertisements [54]. With our dataset, BERTopic grouped ads into 3,284 clusters.

Shortlisting clusters. Given the initial set of clusters, we then scoped our investigation to specific clusters that appeared to contain conflict-related content. To do this, two of the researchers manually reviewed the prevalent keywords in each of the clusters and marked (i.e., qualitatively coded) clusters that contained explicitly conflict-related keywords, such as “war,” “special operation”, and “donations.” In total, we shortlisted 67 clusters, corresponding to 3,382 unique ads.

Refining shortlisted clusters. BERTopic creates clusters based on *semantic* similarity. When we manually investigated shortlisted clusters, we found that despite having conflict-related keywords, several clusters contained advertisements that lacked contextual relevance to the conflict. For example, we found a cluster with *pain*, *healing* and *bone* as keywords that mostly contained clickbait ads that we deemed to be irrelevant to the war context. In another example, we found a cluster with *war* and *veterans* as keywords that mostly contained contextual ads from military publications (e.g., *militarytimes.com*) targeted at US veterans.

Thus, we conducted an additional refinement step in which we manually inspected ads in each shortlisted cluster and removed non-relevant content. Two researchers collaboratively developed a codebook to characterize non-relevant content, and applied the

¹Our crawler crashed on March 12th in both Ukraine and Russia, and again on March 20th and April 18th in Ukraine after running for some time.

²Before topic modeling, we pre-processed the text by removing common English language stop words, and words shorter than two characters. In addition, we set the minimum number of ads in each topic to 10.

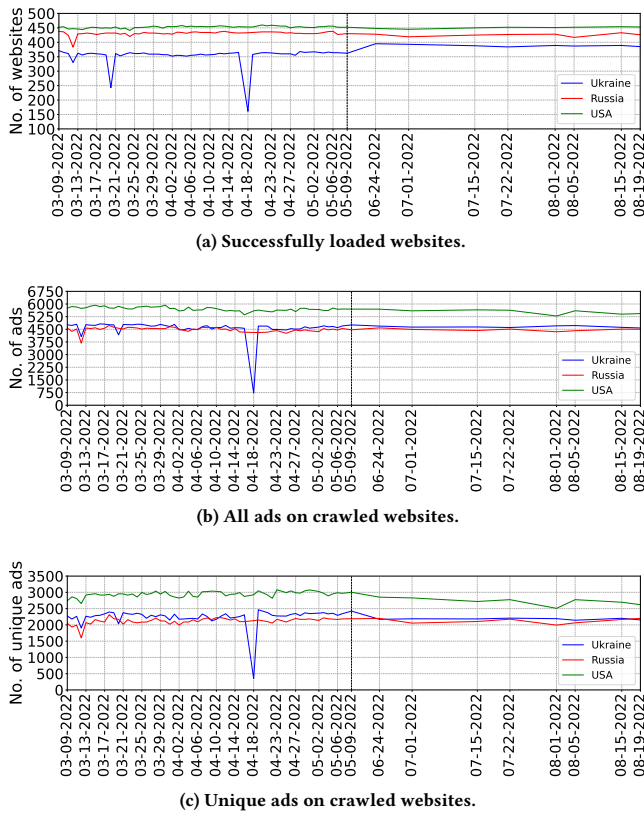


Figure 1: Website crawling and advertisements extraction statistics from March 9th to August 19th 2022.

codebook when reviewing ads. Appendix B.4 describes our codebook from our refining process. After manual refinement, we identified 35 conflict-related clusters, corresponding to 1,197 unique ads.

3 RESULTS: AD ECOSYSTEM AS A WHOLE

We begin by considering the ad ecosystem as a whole: that is, the advertisements we collected as we crawled the same 500 websites from each country, across 5 months. In addition to investigating ads and ad platforms active in Ukraine and Russia, we used US data (a country not directly involved in the conflict) as an additional point of reference. While the US data provides another perspective, we do not consider it to be neutral, nor representative of the rest of the world.

3.1 Overall Ad Volume

Figure 1 shows the number of successfully crawled websites and loaded ads in Ukraine, Russia, and the US. It shows (a) the number of successfully loaded websites, alongside (b) the number of (b) ad impressions and (c) unique ads we collected in each country. We note that our crawler was able to successfully reach fewer websites from Ukraine and Russia than from the US; we consider ad volume in this context (since a website that does not load cannot, of course,

Response Code	Ad requests (count / percentage)		
	Ukraine	Russia	US
451	11,800 / 40.5%	8,247 / 15.6%	74 / 0.3%
403	5,884 / 20.2%	26,649 / 50.3%	6,157 / 25.8%
400	4,091 / 14.1%	11,488 / 21.7%	4,131 / 17.3%
404	3,210 / 11.0%	2,522 / 4.8%	3,984 / 16.7%
502	1,417 / 4.9%	845 / 1.6%	1,116 / 4.7%
500	525 / 1.8%	328 / 0.6%	4,154 / 17.4%
Other	2,197 / 7.5%	2,942 / 5.6%	4,254 / 17.8%
Total	29,124 / 100%	53,021 / 100%	23,870 / 100%

Table 1: HTTP response codes for the ad requests that failed to load in Ukraine, Russia, and the US.

load any ads).³ On a daily average, we successfully loaded 364 websites in Ukraine, 431.3 websites in Russia, and 452.4 in the US (Figure 1a). Note that reported averages do not include data from locations on days where the crawler crashed.

From the successfully loaded websites, we extracted a total of 297,845 ads in Ukraine, 291,436 ads in Russia, and 370,167 ads in the US, averaging at 4,659.4, 4,496.2 and 5,694.9 per day in Ukraine, Russia, and the US respectively (Figure 1b). After deduplication, these ads correspond to 145,437, 137,853 and 189,519 *unique* ads in Ukraine, Russia, and the US respectively (Figure 1c). Our crawling statistics align with prior work [54], which extracted ~5K ads on average per day from 750 websites. Overall, we found that 4.5% and 10.5% of unique ads are in Ukrainian and Russian languages. In the crawls from Ukraine and Russia, we saw that non-Ukrainian and non-Russian language ads also seem to be targeted to Ukrainian and Russian people (giving us confidence in our proxy locations). For example, we observed English ads that contain location-specific keywords such as Kyiv or Moscow, or contextually-relevant information such as English ads for satellite communication devices to tune into local news channels.

3.2 Ad Request Analysis

We now investigate the network requests made to ad platforms to load the ads in our dataset.

We observe fewer advertisements in Russia, as well as more advertising request failures. We observed the fewest number of ads per day on average in Russia. For instance, we observed 26% more ads on average each day in the US than in Russia. Similarly, we observed 3.63% more ads on average each day in Ukraine than in Russia, despite loading fewer websites each day. This is because ad requests failed to resolve in Russia.

Table 1 presents the HTTP response codes for the ad requests, as detected with EasyList [9], that failed to load in Ukraine, Russia, and the US. Ad requests failed the most in Russia, with a total of 53,021 failed requests. In contrast, we observed 29,124 ad requests that failed to load in Ukraine, and 23,870 in the US. Of the ad requests that failed in Russia, just over half (50.3%) failed due to 403 errors, which indicates that the server understands the request, but refuses to authorize it. Though 403 errors are also the most common reason ad requests failed in the US, they represent a much smaller

³Based on the HTTP response codes our crawlers received: in Russia and US, websites mostly failed to load because of refusal from website providers or proxies (i.e., 403 error). In Ukraine, websites (mostly Russian) mostly failed to load with invalid responses (i.e., 502 errors). We detail the website load failures in Appendix B.1.

Ad Platform	Advertising Domain	Requests (count / %)		
		Russia	Ukraine	US
OnAudience	pixel.onaudience.com	8,060 / 94.3%	- / -	- / -
Fifty	visitor.fiftyt.com	5,778 / 97.1%	266 / 3.5%	248 / 2.0%
AtData	api.rlcdn.com	5,017 / 99.3%	6,519 / 99.3%	457 / 5.3%
Lotame	sync.crowdctrl.net	4,781 / 31.5%	431 / 8.8%	574 / 5.5%
Zeotap	mwzeom.zeotap.com	3,235 / 99.1%	- / -	- / -

Table 2: Ad platforms that frequently failed to load in Russia. Count represents total number of failed requests and % represents percentage of failed requests out of total requests for ad platforms in each country.

Ad Platform	Advertising Domain	Requests (count / %)		
		Ukraine	Russia	US
AtData	api.rlcdn.com	6,519 / 99.3%	5,017 / 99.3%	457 / 5.3%
App Nexus	ib.adnxs.com	1,948 / 1.7%	1,633 / 1.8%	754 / 0.4%
Yieldmo	ads.yieldmo.com	1,501 / 53.1%	286 / 98.6%	- / -
Ad4m	ad4m.at	1,163 / 42.7%	982 / 39.4%	- / -
DoubleClick	g.doubleclick.net	1,029 / 1.7%	1,259 / 2.0%	1,316 / 1.8%

Table 3: Ad platforms that frequently failed to load in Ukraine. Count represents total number of failed requests and % represents percentage of failed requests out of total requests for ad platforms in each country.

Ad Platform	Advertising Domain	Requests (count / %)		
		US	Ukraine	Russia
DoubleClick	g.doubleclick.net	1,316 / 1.8%	1,029 / 1.7%	1,259 / 2.0%
Tremorhub	ads.tremorhub.com	1,225 / 30.5%	- / -	- / -
Emxdgt	e1.emxdgt.com	906 / 4.7%	- / -	- / -
App Nexus	ib.adnxs.com	754 / 0.4%	1,948 / 1.7%	1,633 / 1.8%
Lotame	bcp.crowdctrl.net	574 / 5.5%	431 / 8.8%	4,781 / 31.5%

Table 4: Ad platforms that frequently failed to load in the US. Count represents total number of failed requests and % represents percentage of failed requests out of total requests for ad platforms in each country.

portion (25.8%) of the total ad requests that failed. In Ukraine, most requests (40.5%) failed because of 451 errors, which indicates that the requested resource is not available due to legal reasons. As many as 4.5× and 4.3× more requests failed because of 403 errors in Russia as compared to Ukraine and the US. We suspect that this is due to the recent suspension of advertising services in Russia by ad platforms [36–38, 40, 50].

Next, we investigated which ad platforms fail to load in each country and examined whether companies have official advertising policies in place to suspend advertising in Russia. Tables 2, 3, and 4 present the five most prevalent advertising platforms, as detected with EasyList [9], that failed to load in Russia, Ukraine, and the US, respectively, as well as their corresponding failure rates in each location. The most prevalent platforms that failed to load in Russia failed consistently throughout our data collection. Specifically, 4 of the top 5 platforms ad requests failed more than 94% of the time. However, we were unable to find public statements from any of the platforms about their advertising policies.

In Ukraine, the most prevalent ad platform that failed to load (AtData) similarly failed consistently, with over 99% of its requests failing throughout our observation period. However, the subsequent four platforms that often failed to load did so with less frequency. For example, only 53.1% of Yieldmo’s requests failed. On further

Ukraine			Russia		
Origin	Ad Platform	Websites (avg)	Origin	Ad Platform	Websites (avg)
US	Google	85.4%	RU	Yandex	87.8
FR	Criteo	26.7%	US	Google	78.2%
US	Pubmatic	23.6%	RU	Vkontakte	53.3%
US	Magnite	28.7%	US	Facebook	19.1%
US	AppNexus	28.6%	UK	Kantar	19.7%

Table 5: Prevalent ad platforms on Ukrainian and Russian websites in Ukraine and Russian. Websites (avg) column represents the average percentage of websites on which ad platform appeared from March 9 to August 19 2022.

investigation, we found that Yieldmo blocked over 99% of requests for a month at the beginning of our observation period, but resumed resolving requests for the remainder.

We also observed platforms that failed frequently in more than one country, such as AtData in Ukraine and Russia, or Lotame in Russia and the US. One possible explanation could be that these platforms detected our automated crawler as a bot and decided not to resolve our ad requests. However, we still observed trends that supported our hypothesis that companies may be restricting advertising in Russia. For example, Lotame failed approximately 8× more in Russia than in the US. Overall, we surmised that the differences in trends in Russia, Ukraine, and the US show that at least some of the advertising requests were failing because ad platforms are suspending services in Russia.

Prominent US-based ad platforms support both Ukrainian and Russian websites. Several prominent advertising companies, such as Google, suspended their advertising services in Russia because of the invasion [36–38, 40, 50]. We next evaluated if advertising platforms honored their policies by analyzing successfully resolved advertising requests (as detected by EasyList [9]) in Ukraine and Russia. Table 5 presents the prevalent ad platforms in terms of number of requests sent on Ukrainian websites in Ukraine, alongside the prevalent ad platforms in terms of number of requests sent on Russian websites in Russia. We found that Google was the largest ad platform supporting Ukrainian websites, with presence on 85.4% of the Ukrainian websites in Ukraine. None of the key Russian ad platforms (e.g., Yandex) were prevalent on Ukrainian websites. We found that Yandex was the largest ad platform on Russian websites in Russia (87.8%), while Google was the largest non-Russian ad platform, with presence on as many as 78.2% of the Russian websites in Russia. Google’s presence as the largest non-Russian ad platform was surprising because Google suspended their advertising services in Russia on March 3, 2022 [40, 50]. We analyzed Google’s ad platform presence on Russian websites for over a month and did not notice any change in trends. Our measurements corroborate a recent report by NewsGuard, which identified more than 64% (74 out of 116 total) Russian misinformation news websites monetized using Google’s ad platform [51]. Overall, we note that as of August 19th, prominent US-based ad platforms continued to support Russian websites.

4 RESULTS: CONFLICT-RELATED ADS

We now turn to an in-depth analysis of conflict-related advertisements specifically.

Conflict-related cluster	Country			Language				Website origin			
	Ukraine	Russia	US	Ukrainian	Russian	English	Other	Ukraine	Russia	US	Global
Donations (humanitarian)	298.5	286.9	262.6	3.9%	4.2%	87.6%	4.3%	135.2	12.5	325.5	328.8
Conflict-related clickbait	57.3	60.3	36.1	47.9%	37.9%	14.2%	0.0%	471.8	41.7	4.8	29.6
Donations (military)	54.6	47.2	33.1	71.0%	18.5%	3.6%	6.9%	507.6	29.2	1.0	2.2
Anti-war (Demoralizing)	8.4	58.9	11.1	0.0%	98.3%	1.3%	0.4%	157.7	119.9	0.5	0.0
Awareness	39.1	26.2	10.3	31.7%	38.3%	7.4%	21.7%	246.5	30.2	2.5	0.0
Anti-war (Protest)	14.5	16.2	13.0	2.2%	5.1%	92.8%	0.0%	175.0	2.1	0.7	0.0
Donations (Food)	0.7	6.5	29.6	0.8%	0.8%	96.9%	1.5%	2.7	0.0	17.6	11.7

Table 6: Breakdown of conflict related ads across countries, languages, and website origin. The Country and Website origin columns present the number of ads per 100K ads displayed. The Language column represents the percentage of ads in each language for each cluster. We provide additional details on conflict-related topics in Appendix B.3.

4.1 Trends Across Countries

In total we identified 35 conflict-related clusters with 1,197 unique ads, appearing 4,319 times across Ukraine, Russia, and the US (Section 2.2.2). To thematically analyze clusters, we grouped them into topics. Table 6 presents the prevalence of clusters in each country.

We observed that some topics were more prevalent in one country than the other. For example, anti-war ads were more prevalent in Russia, and food donations ads were more prevalent in the US. Other topics, such as conflict-related clickbait, and awareness, occurred more frequently in Ukraine and Russia than the US. We also observed that some occurred with similar frequency across all three countries, such as humanitarian donations ads. We discuss these clusters in more depth in Section 4.3.

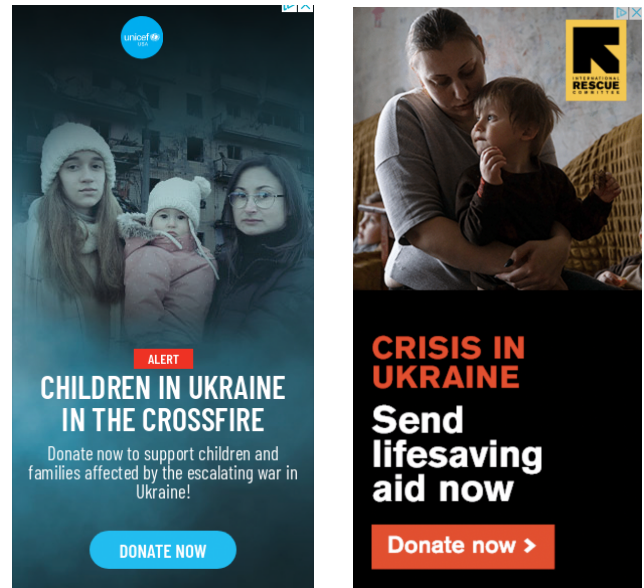
4.2 Longitudinal Analysis

The number of conflict-related ads in Ukraine, Russia, and the US appeared relatively similar. We observed a rise of conflict-related ads in each of our locations near the beginning of our data collection, reaching peaks of 121 appearances a day on March 15, 2022.

Over the following 45 days, conflict-related advertisements declined exponentially, to less than 4 appearances a day by April 29, 2022. Thus, we see that the online advertising ecosystem’s attention largely moved on to other topics, even while the conflict continues. We present a figure showing these trends in Appendix B.2.

4.3 Ad Content Analysis

Next, we qualitatively explored content in conflict-related topics, in order to more deeply understand and describe the ads in these clusters. Throughout this section, we present the text of sample ads and describe their images; additional screenshots can be found in Appendix A. In addition to qualitatively characterizing conflict-related ads, we also aimed to give a sense of how and to whom these ads are targeted. To do this, we considered the frequency with which we see ads on each topic (a) in different countries (i.e., different crawl locations), (b) in different languages, and/or (c) on websites from different origin countries. Table 6 provides the full breakdown of the (relative) frequency with which conflict-related ads appear for (a), (b), and (c). Note that we express the relative frequency in terms of the number per hundred thousand ads displayed to normalize for factors such as the different numbers of websites from each origin country. For example, if some type of ad appeared 600 times per 100000 on US websites and 100 times per 100000 ads on Ukrainian websites, then we would say that they appeared 6x more often on US websites than Ukrainian.



(a) A donation ad on cnbc.com, a US news website, in Ukraine that links to unicefusa.org. Similar ads also appeared on thedailybeast.com, a US news website, in Russia. (b) A donation ad on theglobeandmail.com, a global news website, in Ukraine and Russia that links to rescue.org.



(c) A donation ad on liga.net, a Russian news website, in Ukraine and Russia that links to letshelp.com.ua. The ad is in Ukrainian and translates to: *Helping the elderly during the war. Let’s support grandparents during the war with Russia together.*

Figure 2: Humanitarian donation ads in Ukrainian and English that appear on Russian, US, and other global websites.

4.3.1 Donation Clusters.

Humanitarian donations. Humanitarian donation advertisements solicited funds to help Ukrainians in need. Figure 2 shows campaigns organized by reputable international organizations, such as the United Nations Children’s Fund (UNICEF) [33] and the International Rescue Committee (IRC) [18], as well as Ukrainian NGOs, such as Let’s Help [19]. IRC’s advertising campaign seems to be aimed at helping the general population, while UNICEF’s and Let’s Help’s

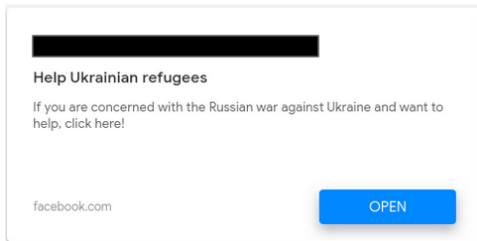


Figure 3: Donation ad on vechirniy.kyiv.ua, a Ukrainian news site, in Ukraine, that links to a Facebook page.



(a) A donations ad on podillyanews.com, a Ukrainian news website, in Ukraine, that links to savelife.in.ua. The ad translates to: *Ukraine above all: how to help stop the war.*



(b) A donations ad on newsru.co.il, a Russian news website, shown in Ukraine. The ad is in Russian and its translation is discussed in Section 4.3.1

Figure 4: Military donation ads in Ukrainian and Russian that appear on Ukrainian and Russian websites.

advertising campaigns are aimed at helping vulnerable populations, i.e., children and elderly, who might be disproportionately impacted by the invasion.

In addition to reputable organizations, we also observed ads from several less-familiar NGOs advertising in Ukraine. For example, Figure 3 shows an advertisement that linked to a Facebook page, and asked people to send donations for Ukrainians to its associated PayPal account. The charity indicated that it was a registered 501 (c)(3) non-profit in the US. However, we could not verify its details on the IRS Tax Exempt Organization Search portal [48]. Despite additional investigation, including following steps set out by the Federal Trade Commission to avoid fraudulent charitable scams [3], we were unable to determine the legitimacy of the NGO. Nevertheless, we redacted the NGO’s name to avoid potentially incorrectly undermining the organization. We suspect that there might be unverified or fake NGOs that claim to collect funds on behalf of Ukrainian people. Similar scams are known to proliferate after other types of disasters, such as extreme weather events [24]. We have reported suspicious humanitarian donation ads to the social media platforms that host their public facing pages, i.e., Facebook and Paypal, and regulatory authorities, i.e., Federal Trade Commission, for further investigation and validation.

Table 6 shows that humanitarian donation ads appeared mostly (87.6%) in English, and with much more frequency on US and other global websites. Humanitarian ads also appeared 2.5× and 26× more on the US websites as compared to Ukrainian and Russian

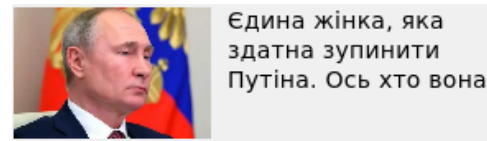


Figure 5: A conflict-related clickbait ad on fakty.ua, a Ukrainian news website, in Ukraine that links to clck.idealmedia.io. The ad is in Ukrainian and translates to: *There is only one woman who can stop Putin. This is who she is.*

websites, respectively. One explanation could be that these ads were contextually targeted to reach a large audience. We also note that humanitarian donation ads appeared with relatively similar frequency in Ukraine, Russia, and the US. That these ads appeared in Russia suggests that advertisers may be running campaigns that do not comply with Russian norms or censorship laws surrounding the conflict (e.g., the use of the term “war” rather than “special operation” [8]).

Food donations. Food donation ads requested support for programs that focused on alleviating hunger in Ukraine. For example, we observed an ad campaign by the UN World Food Program USA that called for providing basic necessities, such as food and water to Ukrainians in need. Its image can be found in Appendix A.

Table 6 shows that food donation ads were mostly (96.92%) in English, and more often placed on US and global websites. They appeared more than 6× on US websites as compared to Ukrainian websites, and did not appear on Russian websites. As compared to Ukraine and Russia, these ads appeared 44× and 4.5× more in the US, respectively.

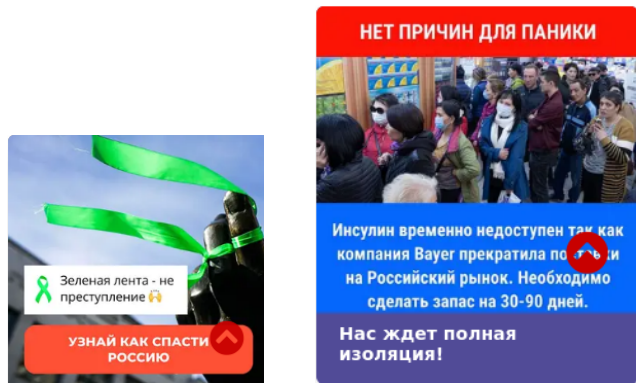
Military donations. Military donation ads urged viewers to help the Ukrainian military. The most prominent advertising campaigns were from Ukrainian NGO’s, such as Come Back Alive / Savelife [1]. Figure 4a shows an example of ad advertisement from Savelife. We also observed military donation advertisements that appeared to be designed for raising funds to buy bulletproof vests for Ukrainian soldiers, such as the one seen in Figure 4b. It translates to:

Fundraising for body armor in Ukraine

Now everyone can help and choose the right side! 60 bulletproof vests have been ordered in Israel, 40 of them have already been paid for, let’s help buy another 20! These are not general words, but very targeted help, to specific people. Don’t scroll through, click!

Military donation ads appeared to be primarily targeted at Ukrainian audiences. Table 6 shows that these ads were mostly in Ukrainian (71.0%), and were the most prevalent conflict-related ads on Ukrainian websites. Military donation ads appeared 17× more on Ukrainian websites than Russian websites, and were virtually nonexistent on US websites.

4.3.2 Conflict-related Clickbait Clusters. We observed clickbait advertisements that used sensationalist language to describe ongoing events in the conflict. Clickbait ads seemed to be designed to drive clicks in order to generate revenue, using strategies such as provoking a viewer’s curiosity without providing additional context.



(a) An anti-war protest ad on bigmir.net, a Russian news website, shown in Russia. The ad is in Russian and its translation is discussed in Section 4.3.3

(b) An anti-war demoralizing ad on bigmir.net, a Russian news website, shown in Russia. The ad is in Russian and its translation is discussed in Section 4.3.3

Figure 6: Anti-war ads in Russian that appear on Russian websites.

Figure 5 shows a clickbait ad campaign which claimed that a specific woman is the key to stopping Putin. We found that many of these campaigns were organized by two companies: MGID [21], and Ideal Media [16]. MGID and Ideal Media specialize in native advertising services, where advertisements often mimic the look and feel of news articles. Conflict-related clickbait may influence viewer’s perception of the conflict, even if they do not directly click on the ad [54].

Table 6 shows that conflict-related clickbait ads appeared to be targeted primarily towards Ukrainian and Russian audiences. They appeared roughly 1.5× more in Ukraine and Russia than in the US. Additionally, clickbait ads were mostly in Ukrainian (47.9%) and Russian (37.9%). We found that such clickbait ads appeared the most on websites that originated in Ukraine: they appeared 11× more on Ukrainian websites than on Russian, and almost 100× more than on US websites. A likely explanation for the absence of conflict-related clickbait ads in Russia, could be the suspension of advertising operations from MGID [4]. In the case of the US, it could be because MGID is a Ukrainian ad platform and websites from US and other countries might not be using their services.

4.3.3 Anti-War Clusters.

Protest. Anti-war protest ads called for the end of the war, showed support for Ukraine, or propagated (negative) information about Putin and his leadership. We found that a portion of these campaigns were sponsored by Ukrainian media companies and government agencies. For example, we observed campaigns organized by the Ukrainian Ministry of Foreign Affairs, Ministry of Social Policy, Ministry of Culture and Information Policy, and Ministry of Youth and Sports, in collaboration with various additional media companies. One such ad campaign promoted an exhibition soccer match between Ukraine and Poland, designed to raise awareness and support for ending the war.

We additionally observed ads that appeared to encourage support for Ukraine in subtle ways. For example, Figure 6a shows an ad has text that translates to:

*Green ribbon is not a crime.
Learn how to save Russia.*

News outlets report that green ribbon has been associated with anti-war protests in Russia [15]. Green in the image specifically represents Ukraine, as it combines the two colors of the Ukrainian flag (yellow, and blue). Anti-war protest ads also directly criticize Putin and his leadership. We observed an ad campaign that informed Russian people that Putin curbs free speech, and its image can be found in Appendix A.

Overall, anti-war protest ads appeared to be organized by entities with perspectives that support Ukraine sentiments. We observed anti-war protest ads with relatively similar frequency in Ukraine, Russia, and the US (Table 6). As with humanitarian donation ads (discussed earlier in the section), the presence of anti-war protest ads in Russia may be surprising, as they appear to be non-compliant with Russian censorship laws. Specifically, anti-war protest advertisements debunk the official Russian narrative of referring to the invasion as “special military operation” [8]. Table 6 shows that almost all anti-war protest ads appeared on websites that originated from Ukraine. Specifically, we found that anti-war ads appeared 84× more on Ukrainian websites than on websites that originated in Russia, and very rarely appeared on websites that originated in the US. However, the vast majority of anti-war ads were in English (92.8%) or Russian (5.1%).

Demoralizing. Anti-war demoralizing ads warned Russian citizens about the negative consequences of the invasion. They share characteristics with conflict-related clickbait ads, such as using alarming language and imagery. For example, we observed ads that exacerbate fears of medical supply shortages (in Russia). Figure 6b shows one such ad that translates to:

*NO REASON TO PANIC
Insulin is temporarily unavailable since Bayer has discontinued distribution to and from the Russian market. It is necessary to stock up on insulin so that the reserves last for 30-90 days.
We are in total isolation!*

Contrary to the claims in the ad, reputable news outlets report that pharmaceutical companies, including Bayer, have continued supplying Russia with essential medical goods throughout the conflict [14]. We found that anti-war demoralizing ads overstate claim and are designed to evoke a sense of panic. We believe that ads in this sub-topic demonstrate how misinformation can be propagated through ads.

Overall, anti-war demoralizing ads appeared to be targeted towards a Russian audience. Table 6 shows that they appeared almost 7× more on websites that originate from Russia as Ukraine, and 5× more than websites that originate from the US. Additionally, we observed anti-war demoralizing ads were predominantly (98.3%) in Russian.

4.3.4 Awareness. Awareness ads spread information and news about the conflict. We observed a small number of campaigns that seemed to report events from a Russian-based perspective. For example, some displayed images that feature the letter “Z,” or used

the term “special operation”. Both these characteristics have been linked with showing support for Russia [30]. We also observed ads that encourage viewers to get live updates about the invasion on Telegram [28]. The campaigns we observed appeared to lead to official accounts associated with Ukrainian media companies, such as *Ukrainska Pravda* [23] and *Telegraf* [27]. Reports have shown that both Ukrainian [35] and Russian [25] parties use Telegram to spread information about the conflict. An example of these types of ads can be found in Appendix A.

Table 6 shows that awareness ads appeared to be primarily targeted at Ukrainian and Russian audiences. We observed these ads in Ukraine and Russia more frequently than the US. Specifically, awareness ads appeared 3.8× and 2.5× more times in Ukraine and Russia than in the US, respectively. Similarly, awareness ads appeared more frequently on Ukrainian and Russian websites. Finally, awareness ads appeared mostly in Ukrainian (31.7%), and Russian (38.3%).

5 DISCUSSION AND CONCLUSION

Limitations. Like all ad ecosystem measurement studies, our study provided visibility into the ad ecosystem but also has limitations: for example, we only observed ads served to our crawlers, so our dataset likely does not reflect all ad campaigns running during our study. Because multi-language text extraction, translation, and automatic topic modeling are imperfect, we reported on our topic clusters primarily qualitatively rather than quantitatively, while giving a sense of the rough volume of ads of each type in our dataset. Additionally, while our study focused on conflict-related ads, we note that these ads do not make up the majority of the ads that we collected: much of the ad ecosystem has continued “business as usual” throughout the conflict. At the same time, because of the imperfection of unsupervised clustering, we may have missed relevant ads or clusters.

Our methodology involved using browser language settings and commercial proxies to appear as Ukrainian and Russian browsers. We verified that the language changes were correctly interpreted by websites and the IPs used by proxy services were indeed the ones that were assigned to us from the respective countries. However, side channels may have been used by some sites or ad platforms to detect our actual physical location in the US [49]. The prevalence of Ukrainian and Russian language ads in our dataset suggests that many of the ads we captured were, at the very least, targeted at people who speak those languages.

We additionally did not analyze advertisements targeted to specific populations (e.g., children, elderly, women, men etc). Future work could explore incorporating demographics in their crawling setup to better understand the advertisements targeted to specific populations.

Recommendations for ad platforms. Major advertisers, such as Google and Meta (Facebook) have existing policies to regulate what types of advertisements are permissible on their platforms [2, 10, 31]. Many of them have extended their policies to the current events in Ukraine [20, 22, 34]. We encourage these types of thoughtful policies, and encourage advertising platforms to audit their own systems, as well as advertisers to ensure appropriate compliance.

For example, similar to work in other contexts [53, 54], we noted large numbers of clickbait-style native advertisements, including in our conflict-related clusters. In addition to spreading low-quality information during a critical time, these ads are also simply exploitative: using manipulative design patterns and sensational language specifically related to a sensitive, ongoing event to “bait” clicks and increase ad revenues. We encourage ad platforms and websites to consider stricter policies on misinformation-adjacent and/or exploitative ads of this type, especially around sensitive events.

Ad platforms also have a potential role in providing transparency and information authenticity. For example, they should provide information to help users understand who places ads on websites. Recall the ads we observed where we were unable to verify the legitimacy of NGOs soliciting charitable funds; these could potentially lead to well-intended donations going to unscrupulous pockets. Ad platforms could implement stricter policies to verify reputable NGOs, and use clear disclosures to help inform users.

Ethics. We did not use Tor to avoid creating unnecessary congestion on the network which might potentially affect people who may be using Tor to access potentially sensitive censored content. We also did not use residential proxies to avoid any inconvenience or risks to people using those IPs.

We did not click on ads while we crawled to avoid impacting advertisers’ budgets. Instead, we identified landing pages by extracting URLs from the ad’s HTML and resolving them when possible, with the intent of not appearing like an actual ad click (e.g., no ad on-click triggers were executed and our landing page requests were sent without cookies).

We redacted the names of organizations to avoid impacting their operations, e.g., the unverifiable NGO in Section 4.3.1. Similar campaigns have previously been publicly reported, such as in the *New York Times* [41].

Overall, we believe that our research had minimal impact on the internet infrastructure, web advertising ecosystem, and organizations operating in Ukraine and Russia.

Conclusion. We collected 225,749 unique ads and analyzed in depth a subset of 1,197 conflict-related ads using proxies located in Ukraine, Russia and the US during the 2022 invasion. This study adds to a growing body of work studying the *content* of ads in the online ad ecosystem, not just its technical mechanisms. Our observations — including Ukrainian government sponsored ads that raise awareness about the conflict, and ads placed in Russia that circumvent censorship and/or spread anti-Russian messaging — underscore the fact that the modern online advertising ecosystem is not used just to advertise goods or services for sale, but to spread information and promote specific narratives. To support future research, we will make our data available upon request.

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Millions Of Ukrainians Need Food Assistance
 Severe Shortages Of Food And Drinking Water. Empty Grocery ...
 UN World Food Program USA | Ad

Figure 7: A food donation ad on detroitnews.com, a US news website, in the U.S. that links to wfpusa.org/countries/ukraine/

A SAMPLE AD SCREENSHOTS

Figures 7, 8, and 9 present example humanitarian, protest, and awareness ads, respectively.

B ADDITIONAL DATA

B.1 Website Load Failure Analysis

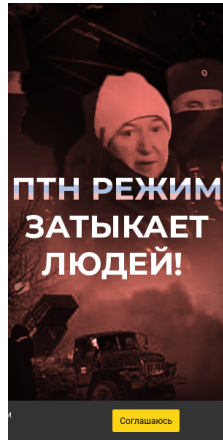
Tables 8 and 9 detail the volume and reasons for website load failures in different countries during our crawls.

Topic	c-TF-IDF	# Clusters	All ads (sum)
Donations: humanitarian	donate, irc, crisis, affected, rescue, aid, ukraine, humanitarian, lifesaving	14	2,685
Conflict-related clickbait	zelensky, armed, deprivation, detained, forces, kyiv, medvedchuk, notes, putin	3	487
Donations (military)	objective, war, volunteers, army, escalating, conflict, war, defence, stop	2	421
Anti-war (Demoralizing)	isolation, complete, waiting, verge, total, sanctions, collapse, coffin, economy	4	237
Awareness	telegram, mriya, operation, special, feared, happening, plea, infohelp	5	230
Anti-war (Protest)	putin, shut, crime, victims, kiev, dynamo, premiership	3	138
Donations (Food)	hunger, hard, strikes, shortage, ukrainians, starving, war, food, send	3	130

Table 7: Manually identified conflict-related advertising clusters, featuring select keywords.



(a) A protest ad on unian.net, a Ukrainian news website in Russia. It promotes an exhibition soccer match between Ukraine and Poland, to spread awareness of the war.



(b) A protest ad on footballua.tv, a Ukrainian sports website in Russia. The ad is in Russian and translates to: *Ptn (Putin) regime shuts up people!*

Figure 8: Protest ads that appear in Russia.



Figure 9: An awareness ad on pravda.com.ua, a Ukrainian news website, shown in Russia that links to t.me/s/ukrpravda_news. The ad is in Ukrainian and translates to: *UT Feed. Latest News in Telegram*. UT stands for a newspaper called ‘Ukrainian Truth.’

B.2 Longitudinal Count of Ads

Figure 10 presents the conflict-related ads from March 9th to August 19th, 2022 in Ukraine, Russia, and the US.

B.3 Clustering Trends Across Countries

Table 7 presents manually identified conflict-related advertising clusters, with select keywords.

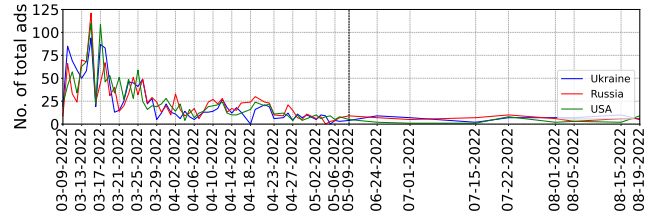


Figure 10: Conflict-related ads from March 9th to August 19th, 2022 in Ukraine, Russia, and the US.

Website origin	Websites (count / percentage)		
	Ukraine	Russia	U.S.
Ukraine	6 / 7.8%	17 / 22.1%	8 / 10.4%
Russia	110 / 51.9%	20 / 9.4%	23 / 10.9%
U.S.	11 / 7.0%	12 / 7.6%	6 / 3.8%
Other countries	2 / 3.8%	3 / 5.7%	2 / 3.8%
Total	129 / 100%	52 / 100%	39 / 100%

Table 8: Websites that frequently (more than 30 days) failed to load in Ukraine, Russia, and the U.S. Count and percentage represent the number and percentage of websites from each country that failed to load.

Response Code	Websites (count / percentage)		
	Ukraine	Russia	U.S.
502	5,363 / 70.6%	252 / 8.2%	254 / 11.5%
403	1,692 / 22.3%	2,381 / 77.5%	1,353 / 61.2%
503	223 / 2.9%	105 / 3.4%	330 / 14.9%
404	199 / 2.6%	212 / 6.9%	213 / 9.6%
451	64 / 0.8%	64 / 2.1%	- / -
Other	60 / 0.8%	60 / 2.0%	60 / 2.7%
Total	7,601 / 100%	3,074 / 100%	2,210 / 100%

Table 9: HTTP response codes for the websites that failed to load for more than 30 days in Ukraine, Russia, and the US.

B.4 Refining Clusters

We identified four categories of non-relevant content: (1) *Contextually irrelevant* ads match keywords in the cluster, but the content is not explicitly related to the conflict. (2) *Misclassified* ads do not contain keywords in the cluster, and contain content that is not conflict-related. (3) *Miscaptured* content represents instances our crawler captured with elements that are not ads, such as embedded YouTube videos or Twitter threads. (4) *Malformed* content includes instances where captured ads are occluded, or contain partial ad images.