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Web-based child pornography: The global impact of deterrence efforts and its consumption on mobile platforms

Chad M.S. Steel*

Electrical and Computer Engineering – Computer Forensics, George Mason University, Nguyen Engineering Building, Room 3100, MS 2B5, 4400 University Drive, Fairfax, VA 22030-4444, USA

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ABSTRACT

Our study is the first to look at mobile device use for child sexual exploitation material (CSEM) consumption, and at the global impact of deterrence efforts by search providers. We used data from Google, Bing, and Yandex to assess how web searches for CSEM are being conducted, both at present and historically. Our findings show that the blocking efforts by Google and Microsoft have resulted in a 67% drop in the past year in web-based searches for CSEM. Additionally, our findings show that mobile devices are a substantial platform for web-based consumption of CSEM, with tablets and smartphones representing 32% of all queries associated with CSEM conducted on Bing. Further, our findings show that a major search engine not located in the United States, Yandex, did not undertake blocking efforts similar to those implemented by Google and Microsoft and has seen no commensurate drop in CSEM searches and continues to profit from ad revenue on these queries. While the efforts by Google and Microsoft have had a deterrence effect in the United States, searchers from Russia and other locations where child pornography possession is not criminalized have continued to use these services. Additionally, the same lax enforcement environment has allowed searchers from the United States to utilize Yandex with little fear of detection or referral to United States law enforcement from the Russian authorities.

Introduction

Online child pornography is a growing problem, resulting in a steady increase in the number of arrests and convictions seen in the United States over the past several decades (Wolak, Finkelhor, & Mitchell, 2012; Wortley & Smallbone, 2012). Because the Internet is global, so is the distribution and consumption of child pornography, and as such it is subject to widely differing levels of regulation and enforcement (Taylor & Quayle, 2003).

In online child pornography offenses, child sexual exploitation material (CSEM) is sought or shared using Internet-based technologies. Underlying each of the images, and increasingly videos (Wolak et al., 2012), is a victim who suffers revictimization with each viewing (Von Weiler, Haardt-Becker, & Schulte, 2010). As online technologies evolve, so do the methods used by offenders to acquire and distribute contraband images and videos. Previous work has quantified CSEM consumption and distribution in peer-to-peer networks (Steel, 2009a; Wolak, Liberatore, & Levine, 2014), web search engines (Steel, 2009b), and chat rooms (Briggs, Simon, & Simonsen, 2010). Additionally, more recent work has looked at sexting and the mobile distribution of images through text messages using Multimedia Messaging Services (MMS), by minors to other minors and between adults and minors (Mitchell, Finkelhor, Jones, & Wolak, 2012; Wolak & Finkelhor, 2013). Browsing and

* Correspondence to: 7902 Foote Lane, Springfield, VA 22151, USA.

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content consumption, and therefore search engine use, are growing on mobile devices (Sullivan, 2013). Despite the growth of mobile search engine usage, little work has been done to quantify the consumption of CSEM through searches on mobile devices.

Along with peer-to-peer transactions, where users share content by running specialized software that does not require a central service, web-based searches of indexed content are believed to be one of the primary methods used by individuals to find and acquire CSEM online. Web based technology has changed dramatically since its inception. There is an increased globalization of search engine usage, with two of the top four global search engines, Yandex and Baidu, hosted outside of the United States (Bonfils, 2013). To help combat the global problem of CSEM viewing and distribution, Microsoft and Google deployed technical controls across their search platforms in mid-2013. These controls included the removal of CSEM content from their indices, enhanced filtering of exclusively CSEM-related queries, and deterrence messaging to users when queries strongly associated with CSEM are entered (Watt & Garside, 2013).

In this paper, we evaluate the demand for web-based CSEM on mobile platforms, measure the impact of the filtering put in place by Microsoft and Google on web-based CSEM, and assess the global demand on search engines for CSEM content.

Web-based Child Sexual Exploitation Material

Web-based CSEM transactions can use multiple web-enabled technologies, ranging from webmail software to live chat rooms (Rogers & Seigfried-Spellar, 2014). Some of these are heavily monitored by automated tools. The most common approach for automated monitoring is to use sets of hashes. Hashes are unique signatures based on a mathematical function that can be generated for previously identified child pornographic images and movies. Google and Microsoft use sets of hashes to identify child pornography in webmail and Google Drive/OneDrive storage areas. When a file is identified as having a hash signature that matches known child pornography, the providers contact law enforcement and provide the relevant content from their systems (McKalin, 2014). Other platforms, such as web-based Internet Relay Chat (IRC) clients, are largely unmonitored. IRC transactions are generally one-to-one transactions, however, which limits the technology's effectiveness for mass distribution, though individual trading remains prevalent (Jenkins, 2003).

Ultimately, search engines are the most common method for finding content, including CSEM, on the Internet. Despite legal defense arguments that individuals "stumble across" child pornography, there is little evidence of individuals accidentally finding child pornography when surfing the web for legal content. As such, child pornography must be actively sought out by online offenders. Initially, this means using a search engine to identify locations or technologies by which the content can be acquired. Once identified, content can be consumed by visiting locations that are identified through searching or through the use of related technologies. On the web, that means utilizing popular search engines like Bing, Google, Yahoo, Baidu, and Yandex as gateways. For peer-to-peer software, it means utilizing the search functionality built-in to a particular software client.

Offenders generally begin searching using broad terms like "preteen nude" that are eventually refined to target specific content, using terms of art like "PTHC" (preteen hardcore) or "boylover". The use of these terms leads searchers to chat rooms, forums, and websites where they can acquire their target content (Steel, 2014). For those distributing CSEM, search engines represent the primary mechanism for advertising their wares. While word of mouth can be utilized within underground forums to alert consumers to new avenues to acquire contraband, finding these forums initially is still done through search engines.

There are many gaps in the current research into web-based CSEM, and the rapid evolution of mobile platforms has necessitated revisiting past research efforts. Quantifying and qualifying web-based searches for CSEM are critical in understanding the changing nature of the content, its consumption, and its distribution for law enforcement, technology providers, and government regulators.

Law enforcement is encountering child pornography at an increasing rate, in the United States and across the globe (McManus & Almond, 2014; Wolak et al., 2012). As part of that increase, law enforcement is more frequently encountering mobile devices when executing search and arrest warrants and when conducting knock-and-talks, where investigators request the consent of subjects to forensically preview their electronic devices. For search warrants, law enforcement needs to show that there is probable cause that mobile devices are being used to commit child pornography offenses, and prior research has not addressed this need. Additionally, law enforcement budgets are limited, and justifying training for forensic examiners in mobile technologies requires statistics that show the need for education in smartphone and tablet analysis. Finally, understanding the likelihood that a mobile device contains child pornography can assist in triage efforts when multiple devices are seized and when deciding what devices to preview during a knock-and-talk.

Technology providers are taking a more active interest in combating child pornography as well. For providers like Google and Microsoft, being able to accurately assess their blocking efforts allows them to show deterrence value. This can assist organizations in obtaining continued funding for active detection and deterrence efforts, encourage other providers to adopt similar methods, and support the funding of core research that can facilitate these actions.

For regulators, understanding usage patterns, both domestic and foreign, can drive policy decisions. Because CSEM distribution and the sexual exploitation of children are global problems facilitated by Internet technologies, decisions must be made beyond the creation of domestic laws. These decisions can include putting pressure on foreign providers, funding domestic enforcement and intervention efforts, and directing limited funds toward the highest impact areas.

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Current Study

This paper utilizes the data mining tools present in Google, Bing, and Yandex to identify the current terms used to search for CSEM in web queries, utilizing the methodology outlined below. The top terms are then used to evaluate three specific areas of CSEM consumption. First, the use of mobile devices to search for web-based CSEM is evaluated, and the belief that individuals seeking CSEM are early adopters of that technology is assessed (Steel, 2014). Second, the impact of the recent actions by Microsoft and Google to eliminate child pornography from their indices and deter CSEM-related queries is reviewed. Third, the global use of Yandex, a search engine hosted in a loosely regulated environment, is contrasted with Google and Bing usage as a mechanism for individuals seeking CSEM. Conversely, the use of Google and Bing by individuals from loosely regulated environments to find CSEM is contrasted with usage from strongly regulated environments.

Methods

Google, Yandex, and Bing are three of the five largest global search engines representing approximately 75% of the global search market (Bonfils, 2013). All three search engines offer web-based tools or application program interfaces (APIs) that allow access to current and historical query statistics, including volume. Additionally, they provide various levels of information on related queries to a particular term (described in the Data Iteration section below), and on the locations from which these queries are being generated.

Because of the availability of the data, the representativeness of the sample set, and the roles taken by Microsoft and Google to combat child pornography, data from the three search platforms noted above was used as the basis for this study. Baidu, the second-ranked global search engine, does not support multiple languages, catering exclusively to Chinese speakers, and is heavily censored for political reasons. Therefore, it was not analyzed as part of this study. Yahoo, the other search engine rounding out the top five, uses various other search engines that are rebranded, including Bing in the United States and Google in Japan, and therefore was not used to avoid double-counting aggregated results from these systems (Toto, 2010).

Term List Generation

A current list of search queries highly correlated with CSEM was generated to utilize in the experiments below. A prior list of web-based queries, generated in 2009 (Steel, 2009b), was found to be no longer valid, with certain terms dropping in usage without correlation to the Google and Microsoft efforts (e.g. r@ygold) and with other queries growing in popularity due to new delivery mechanisms (e.g. searches including the term “imgsrc.ru”, a site popular with child pornographers) (Steel, 2014).

To generate the list, several high volume seed terms from the 2009 list were used. The terms were submitted to both the Google Trends and the Yandex Wordstat tools, which were used to identify highly correlated terms. The new terms were iteratively resubmitted, then the list was scrubbed to remove terms that had a correlation with CSEM of less than 75% (i.e. at least 75% of the related queries were CSEM specific based on manual review). Terms like “Lolita”, which is associated with CSEM but also refers to a proper name, to a perfume line, and to a famous novel, were eliminated during this step. The remaining queries were all highly (though not exclusively, in some cases) associated with CSEM searches ($n = 72$).

In addition to generating a list of terms associated with CSEM, a similar approach was used to generate a list of the top terms associated with adult SEM ($n = 100$). This list was used to generate a baseline level of adult SEM usage to control for any statistical variance that might be due to a general increase or decrease in searches for all SEM, both adult and child.

Finally, a third list of terms was generated based on the top queries, excluding SEM queries, conducted on desktop/laptop, tablet, and phone-based platforms ($n = 100$) in August 2014. This list was used to generate a baseline level for general search activity, providing a comparison for the how search habits on traditional v. mobile platforms differ with respect to CSEM.

All three lists were limited to English-language queries, which represented the majority of the terms identified.

Data Iteration

Each search provider makes different statistical information available to researchers. Keyword statistics from both Bing and Google were used to evaluate the effects of their blocking efforts. Because it was the only provider to breakdown queries by platform, Bing data was used to evaluate the usage of mobile devices to search for CSEM. Globalization was evaluated using geolocation data from all three search providers. To exploit this data in a programmatic fashion, a serious of scripts were written to iteratively query and extract bulk information from the providers’ tools. Where direct access to query the data was not available, the parsing of the HTML response data was performed.

The Google Trends tool provided three types of information – the relative query volume per region, the relative query volume over time, and the closest related queries to the target query. The Google Trends information was not made available via an API and was queried indirectly using a third party software library (PyGTrends).

Yandex’s Wordstat tool provided information similar to Google Trends, showing the absolute query volume and affinity per region, the absolute query volume over time, and the closest related queries to the target query. Affinity is calculated by

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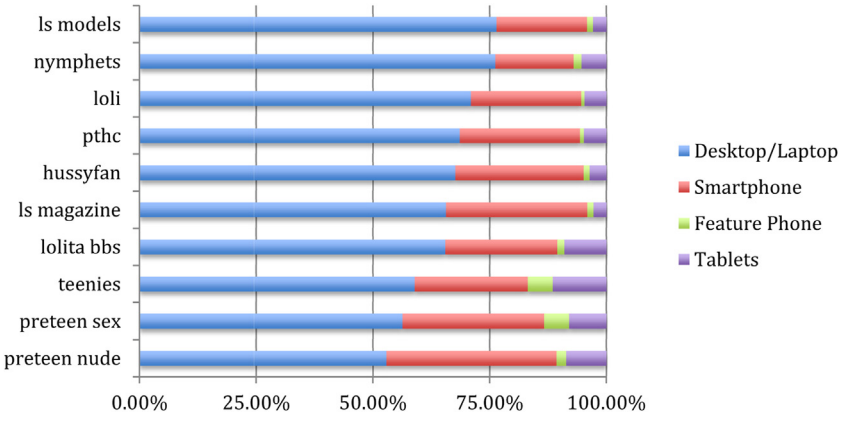

Fig. 1. Top CSEM terms by device.

dividing the percentage of queries that are CSEM-related for a country by the percentage of queries that are CSEM-related from all countries. Yandex's information was iteratively acquired using custom software written for this research.

Bing's Keyword Research Tool provided current search term volumes as well as breakdowns by device and region. Unlike Google and Yandex, Bing also provided breakdowns of each term by mobile and traditional platforms. Bing's information was iteratively acquired using custom software written for this research.

The resultant information for all three tools was imported into Excel and normalized for data consistency. The Yandex and Bing absolute results were transformed into relative results to allow direct comparison with the results from Google. Similarly, the affinity on Google was calculated using the relative volumes of the top innocuous keywords as a baseline for the purposes of calculating regional affinities for comparison to Yandex.

Notes on Research

The intent of individuals conducting searches using CSEM-associated queries cannot be directly determined due to the inability to see what individual searchers ended up viewing as a result of their searches. Terms that may be of research interest or return news stories on CSEM, for example the term "child pornography" itself, were not found to be associated with the terminology used by those seeking images and videos. Additionally, prior work has shown that the terms in the queries identified in this research are consistent with how child pornographers advertise content using filenames (Steel, 2009a). Because the possession of child pornography is illegal in the United States, researchers and others seeking general information on child pornography are precluded from downloading actual images and/or movies.

As a final note, this research does not distinguish between child pornography and child erotica. In some jurisdictions, child pornography requires a sexual act as opposed to just nudity, which may be considered erotica. The more general term "child sexual exploitation material" is used to encompass both child pornography and child erotica, except where a legal distinction is necessary or the use of a more specific term is appropriate based on the context.

Results

Mobile Devices

Mobile devices have proliferated, with smartphones and tablets now outselling desktops and laptops by a significant margin. In 2013, mobile devices represented approximately 80% of all new device shipments, with increased growth expected over the next several years (Columbus, 2013).

Digital CSEM has been linked to mobile devices, including cell phones and tablets. Investigators are increasingly encountering these devices when executing search warrants, and forensic techniques have evolved to analyze them for child pornography (Bennett, 2012). CSEM consumers have been suspected of being early adopters of mobile technologies. These devices are generally purchased as content consumption devices, as opposed to content creation or distribution devices.

To test the assertion that web based CSEM is moving toward mobile devices, we compared the searches conducted for CSEM using desktops and laptops against those conducted on smartphones, feature phones, and tablets. The August 2014 search data were utilized from the Bing search engine, which provided breakdowns by device type, with laptops and desktops bundled as a single device type.

For a baseline comparison, the number of searches conducted using the top innocuous search terms was collected, as well as the top search terms associated with adult SEM for the same period (Google, 2014). These were compared to the top 10 CSEM searches conducted using the same devices, shown in Fig. 1. The median breakdown by device for each of these is shown in Fig. 2.

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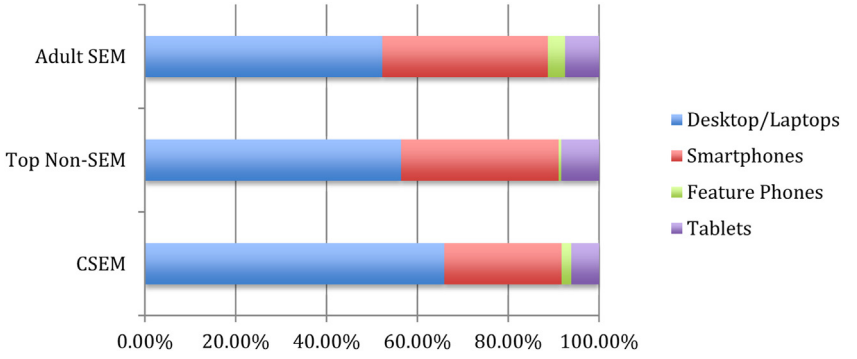

Fig. 2. Technologies used to search for CSEM.

As identified above, all of the top CSEM terms were most often searched using desktops and laptops ($m = .66$), followed by smartphones ($m = .26$) and then tablets ($m = .06$). Feature phones ($m = .02$) made up the smallest percentage of searches. This traffic can be normalized based on the number of overall searches conducted using each category, showing an even greater preference for desktops and laptops by those seeking CSEM ($m = .8$). Conversely, individuals searching for non-SEM content and individuals searching for adult SEM are moving more toward mobile devices, with almost half of the top non-SEM searches ($m = .44$) and adult SEM searches ($m = .48$) conducted using mobile devices.

Search Engine Blocking

In July 2013, the British Prime Minister called upon Microsoft and Google to take steps to stop web-based child pornography. The news made international headlines, and both Google and Microsoft outlined plans to take immediate steps to combat child pornographers that used their search products to find illegal content (Ward, 2013). In November 2013, both Google and Microsoft announced that they were removing child pornographic content from their indices, filtering search results, and returning warnings when specific searches were used (Watt & Garside, 2013). Users searching for CSEM on Google in the United States are provided a Google Ad warning:

Protecting children from sexual abuse
Child sexual abuse imagery is illegal.
At Google we work with child protection experts to find, remove and report this material because we never want it to appear anywhere on our products, including our search results.
To report child sexual abuse content or to find help for a child in the US, please contact the National Center for Missing & Exploited Children.

Similarly, Bing returns an ad with the following warning:

Child porn, exploitative, or abusive content is illegal.
Get help now

Because the controls were widely publicized, and because the search engines represent a combined 86% of the United States search market, it is expected that their efforts would have a significant impact (McGee, 2013). To quantify the impact, Google Trends was used to look at search traffic from January 2011 through August 2014 for terms associated with adult SEM and for terms associated with CSEM. The terms were normalized based on their historical volumes to a value of 1.0, and the average results for each category were calculated. The results are shown in Fig. 3.

The data show a precipitous drop in child pornography searches starting in July 2013, commensurate with the announcements noted above. CSEM query volume fell by 67%, while adult SEM volume remained steady. Prior to July 2013, CSEM volumes had a weak correlation with adult CSEM volumes ($r = .16$). Between July 2013 and July 2014, CSEM volumes had a moderate to strong negative correlation with adult SEM volumes ($r = -.53$).

One possibility for the precipitous decline is that web based search traffic for CSEM was directed to search engines in other countries. To evaluate this possibility, the search traffic from Yandex was evaluated using the same terms for the same period (*Note*: Yandex data were not available before August 2012). The results are shown in Fig. 4.

The Yandex data show no decline in CSEM searches since July 2013, and no increase in adult SEM over the same period. Additionally, the overall Yandex results show a weak positive correlation ($r = .16$) between August 2012 and July 2014, the same level of correlation between adult CSEM and CSEM that was present prior to July 2013 in the Google results. Given Yandex's dominance as the largest English language search engine outside the United States, these results do not support the hypothesis that CSEM search traffic shifted to other countries.

Global Impact

Yandex is the most popular search engine in Russia, commanding a 62% market share, and is the fourth ranked global search engine (Gesenhues, 2014). While United States usage of Yandex is small compared to Google and Bing, it is still

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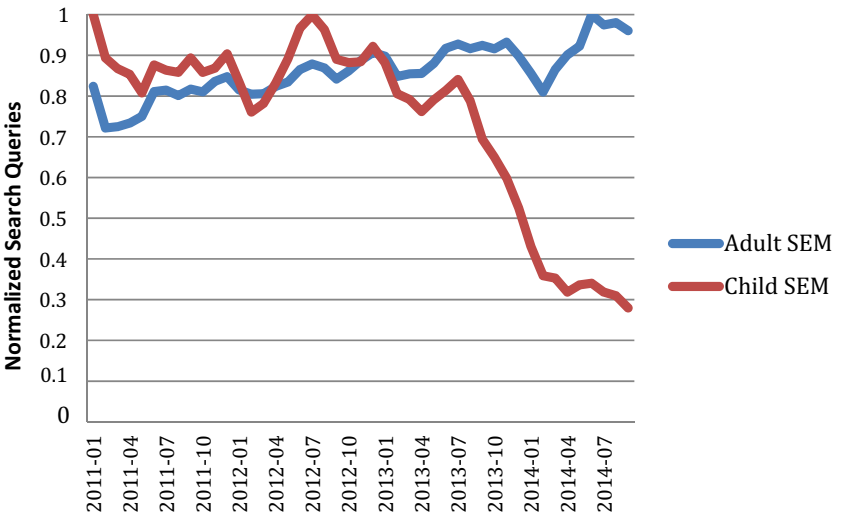

Fig. 3. CSEM search term relative volume – Google.

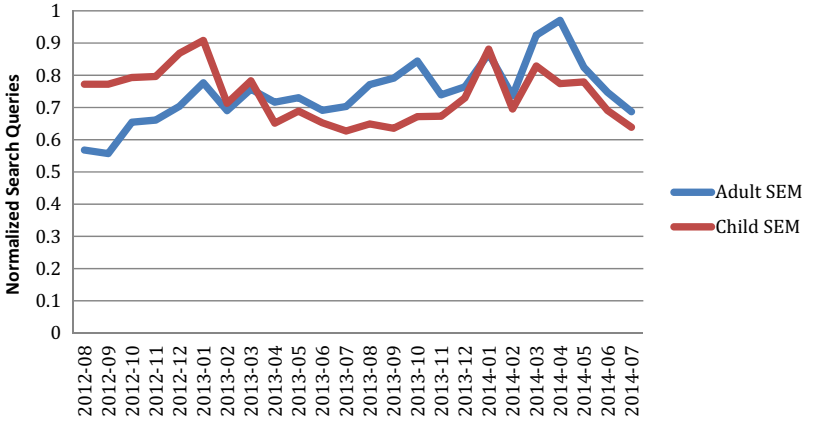

Fig. 4. CSEM search term relative volume – Yandex.

Table 1
Rank and affinity of CSEM queries on Yandex.

Country	Relative rank	Affinity
United States	1.00	33.03
Germany	0.99	27.85
France	0.58	60.79
Italy	0.33	30.7
Netherlands	0.31	64.38
Japan	0.30	197.27
Poland	0.19	43.03
United Kingdom	0.16	16.15
Sweden	0.15	47.44
Czech Republic	0.12	16.12

substantial. Based on the volume figures analyzed, traffic from the United States represents approximately 1.3% of the queries conducted on Yandex. While not large percentage-wise, it still represents approximately 60 million queries per month.

The detailed search results show that CSEM queries are being conducted on the Yandex search engine from regions outside of Russia (reported as relative rank based on the specific country's volume divided by the highest country's volume). To determine the likelihood that Yandex is being targeted by those seeking CSEM globally, the number of CSEM queries performed were ranked related to the highest non-Russian country (the United States). Additionally, affinity was calculated for CSEM queries. The results are shown in Table 1.

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Table 2
Relative rank and affinity of CSEM queries by country on Google.

Country	Relative rank	Affinity
Czech Republic	1.00	60.72
Russia	0.92	60.02
Mexico	0.86	81.33
Germany	0.78	62.66
Costa Rica	0.74	129.98
Norway	0.70	64.76
Peru	0.53	46.93
Canada	0.50	5.79
Sweden	0.49	123.17
Chile	0.46	116.44

For comparison purposes, the affinity for general adult SEM searches conducted on Yandex by United States searchers was 2.4. The baseline affinities show that searchers from the United States are 2.4 times more like to be searching for adult SEM than expected.

Individuals from the United States are 33 times more likely to be searching Yandex for CSEM than predicted based on overall usage. Additionally, other countries, led by Japan at 197 times the expected amount, appear to be using Yandex for CSEM searches at high rate.

Although Google results show an overall decrease in CSEM usage, there are specific countries that are still using Google to search for CSEM at a relative rate higher than their non-SEM querying. The highest absolute volume of CSEM queries comes from the Czech Republic, followed by Russia and Mexico. Despite having significantly greater overall search volumes for general queries, neither the United States (relative rank = .38) nor the United Kingdom (relative rank = .21) were on the list of the top querying countries. All of the countries showed high affinity numbers, indicating a disproportionate number of searches for those countries were CSEM-specific. Detailed results are shown in Table 2.

Discussion

The use of mobile devices by those seeking CSEM is expected to rise over the next several years. The porting of peer-to-peer software like Frostwire to mobile platforms will generate new usage patterns on these devices (Cole, Silva, & Mislan, 2012). While the assertion that CSEM seekers are early adopters of technology was not supported by this research, the idea that these individuals are using these mobile devices for web-based consumption is directly supported. Over 34% of all web-based queries for CSEM on Bing were conducted using mobile devices. Although this lags the overall number of mobile device queries on Bing, which refutes the idea that CSEM consumers are moving their illicit activity to mobile platforms faster than the general public, it still represents a large and growing platform for illicit content consumption. Because of the substantial volumes present, law enforcement should prioritize the review of smartphones and tablets when they are encountered. Feature phones had a small usage volume and should be triaged as lower priority when seized pursuant to a search warrant or consent search. Additionally, the growth in mobile consumption of CSEM highlights the need for the development of more rapid triage tools for these devices, and law enforcement should consider them high priority targets when conducting knock-and-talks.

The identification of web-based mobile consumption of CSEM provides a new use case for mobile devices that may be neglected in research circles. Extensive research on MMS-based transmission of SEM (i.e. sexting) using mobile platforms has occurred, but the usage patterns and user profiles appear to be much different than the general CSEM consumer (Mitchell et al., 2012; Wolak & Finkelhor, 2011). With the growth of larger screens on smartphones and the increase in tablet sales, this will be a growing market for CSEM consumers in the foreseeable future.

When Google and Microsoft publicly undertook efforts to block child pornography, they provided a unique opportunity to measure the impact of their actions. While causality cannot be directly attributed to a single event, there is a strong correlation starting in July 2013 between the announcement of their blocking efforts and a drop in CSEM requests through their services. There are two pieces of evidence, however, that tend to support causality based on the new technical controls and warnings. First, during the same period in time there was no statistically significant drop in either general searches or in searches for adult SEM. Second, a comparison to Yandex, a site that did not implement similar controls, showed a similar stability in adult SEM query volume as Google, but no drop in the number of CSEM queries since July 2013. The lack of a commensurate increase in search activity at Yandex corresponding to the decline at Microsoft and Google also implies that individuals are not seeking the same content using other web-based search engines, though a migration to other technologies such as peer-to-peer software is a possibility.

Fewer locations in which CSEM content is available and more messages highlighting the negative impact of CSEM will reduce the normalization of the act of viewing the material (Quayle & Taylor, 2002). Because web-based search engines are the likely gateway of choice for those looking to find CSEM for the first time, the trend of technical blocking and deterrence messaging pioneered by Microsoft and Google will hopefully be continued by other technology providers.

The adoption of non-US-based search engines by CSEM consumers was shown to be higher than that of other web users. In the case of Yandex, overall adoption by users from the United States has been fairly low; however the United States is

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the largest non-Russian consumer of CSEM on that search platform. One possibility for use of the Yandex search engine by those seeking CSEM outside of Russia is the fact that it does not filter results. Additionally, Yandex is a Russian company, and possession of child pornography is not illegal in Russia (only distribution and production are illegal, and only of children younger than 14) (*Making and Circulating Materials or Articles with Pornographic Images of Minors*, 1996). Because possession and viewing of child pornography are legal in Russia, Yandex is less likely to report search activity conducive to those acts to the United States authorities.

Because the volume of CSEM searches on Yandex appears to be stable and has not grown since the Microsoft/Google blocking initiative, this indicates that CSEM consumers found Yandex prior to the blocking and have been using it consistently, as opposed to migrating as a result of the blocking. Similarly, the highest volume consumers of CSEM using Google are in the Czech Republic and Russia. Similar to the high volumes seen on Yandex due to a lack of blocking, the lack of a legal environment that criminalizes the viewing child pornography in these regions contributes to overall increases in the global consumption of CSEM.

Future Research

Although it was outside the scope of this research, the drop in CSEM queries over the past decade has not been uniform. Certain terms-of-art such as "R@ygold" and "LS Magazine" have shown an overall Zipfian decline, while others such as "preteen nude" have had a more linear decline, with a precipitous drop in July 2013. This factor, and an overall change in the most popular terms (approximately 20% were different) between 2009 and 2014 (Steel, 2009b), indicates that the subculture uses a rapidly changing language, and further research into this area is warranted.

One limitation of this research is that it was not designed to differentiate between a general deterrence impact (fewer individuals searching for CSEM) due to the Microsoft and Google efforts or a shift to a less well regulated technology. CSEM consumers may have shifted to darknet sites hosted on networks that anonymize user identity and location (e.g. TOR) or to peer-to-peer networks with no filtering. Further research quantifying the use of these systems over time would be important in identifying overall trends in CSEM consumption.

The research above used Bing data to evaluate mobile usage. Despite Google's dominance on mobile devices with its Android platform, Google does not provide breakdowns of searches by device type. A confirmatory study using the more broadly representative Google data, if it is ever made available, would be appropriate.

Finally, peer-to-peer technologies on mobile devices represent a growing concern, and shift the usage pattern of the devices from content consumption and creation platforms to content distribution platforms. While limited bandwidth and data plans that charge per gigabyte transferred are likely to limit their use on cell networks, Wi-Fi based connections for smartphones and tablets provide viable opportunities for distribution using mobile devices. The quantification and qualification of peer-to-peer usage on mobile platforms for CSEM consumption and distribution should be monitored as a potential growth area.

Conclusions

The blocking efforts by Microsoft and Google were not paper exercises – they had a rapid and significant impact on CSEM searches. Their efforts show that technical controls aimed at education and prevention can be effective deterrents. Absent strong enforcement and technical countermeasures, sites like Yandex end up attracting a disproportionately large number of CSEM searchers. More importantly, Yandex generates direct ad revenue from individuals using CSEM queries, further monetizing the sexual exploitation of children. Similarly, sites like Google, despite increased enforcement, still experience higher than expected query volumes from countries where viewing of child pornography is not strongly enforced or criminalized. These results indicate a need for global political efforts to combat online CSEM – individual country and company efforts are laudable, but insufficient.

As mobile platforms become the dominant consumption devices for content, the overall proportion of web searches conducted on these systems will increase. The use of these devices for CSEM viewing is lagging overall mobile search usage, but is substantial enough that it represents an area of challenge for law enforcement and for forensic research that cannot be ignored.

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