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

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A R T I C L E   I N F O

A B S T R A C T

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.

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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

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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.