IWF
Internet Watch Foundation

Trends in Online Child Sexual Exploitation:
Examining the Distribution of Captures of Live-streamed
Child Sexual Abuse

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Preamble

Studying and reporting on distribution of child sexual abuse imagery online presents complex challenges. Communicating effectively with all stakeholders, including professionals, policy-makers, those in a parental role and the children themselves about the nature and scope of its distribution is vital to ensure terms and concepts are universally understood and important messages are not lost. Equally, it is critical to ensure that in doing so the victims are treated with dignity and respect and any potential for revictimization is minimised.

One of the major issues to be overcome is that of terminology. Changes in technology use in recent years have given rise to new ways to describe the nature of child sexual abuse imagery, including the use of terms such as "sexting" and "self-produced" sexual abuse imagery. Such terms are open to interpretation, and this lack of a consistent definition has led to conflicting research findings in relation to motivation and prevalence, which in turn can lead to inconsistency in the formulation of policy and intervention strategies. Broad definitions also do not take into consideration the potential motivations of children depicted – notably, the extent to which they may have been forced or coerced, even where no-one else is physically present within the imagery. Without being able to describe the full context, there is the danger that the use of these terms may be misinterpreted as "victim-blaming".

An international Interagency Working Group initiated by the child protection agency End Child Prostitution and Trafficking (ECPAT), sought to address this issue. By examining common terms relating to child sexual exploitation and identifying ambiguous or problematic terms the group aimed to formulate universal definitions. Their findings were published in 2016 in what are commonly referred to as the "Luxembourg Guidelines"[1]. The term "live-streamed child sexual abuse" used within this study was devised with reference to the recommendations made within these guidelines and should be interpreted accordingly. Software is used to create a permanent recording (commonly called a "capture") of the live-streamed child sexual abuse for redistribution and still images from this capture are also produced and distributed.

Live streaming of child sexual abuse (also referred to as "webcam child sexual abuse[2]"), is often equated solely with situations which occur in regions such as South East Asia where a child is forced by facilitators (commonly a family or community member) to appear in front of a webcam to engage in sexual behaviour or be sexually abused. This abuse is live streamed over the internet to a remote offender who is paying to view and direct the activities[3]. Whilst this is sadly and undeniably recognised as an established form of online child sexual abuse, it is uncommon for IWF to encounter captures of such broadcasts being publicly distributed online. The more common scenario the IWF encounters is captures of live-streamed child sexual abuse involving white girls, apparently from relatively affluent Western backgrounds and who are physically alone in a home setting, often their own bedroom. This suggests that traditionally-recognised risks for children to become victims of sexual exploitation offline (for example homelessness or economic vulnerability[4]) may not apply here and highlights the need for further research in this area.

An additional challenge when reporting on trends in child sexual abuse imagery is how to convey effectively what is being pictured whilst, at the same time, being sufficiently circumspect to avoid the possibility of causing unwarranted distress to members of the public, including those who may have experienced sexual abuse. Finally, and importantly, descriptions need to avoid the risk of being used to further the exploitation of children and young people. The examples in the paper therefore consist of amalgamations of typical scenarios which appeared in the imagery assessed and are included for the sake of clarity – for example, to explain how imagery could be classified as depicting penetrative sexual activity when a child was physically alone.

Despite these challenges, IWF is in an almost unique position to provide data on trends such as the distribution of captures of live-streamed child sexual abuse being distributed online, including the websites where this content is being displayed. While the internet has huge social benefits for children, as with any aspect of life it also has its risks. By publishing these findings, we hope to increase awareness of those risks, thereby informing the intervention strategies of all those working to enhance online child protection, and empowering those in a parental role as well as children and young people themselves to take steps to ensure they are better protected online.

[1] "Terminology Guidelines for the Protection of Children from Sexual Exploitation and Sexual Abuse" (http://luxembourgguidelines.org/english-version/)

[2] BBC – "UK paedophiles pay to watch webcam child sexual abuse in the Philippines" (http://www.bbc.co.uk/news/av/uk-25750997/uk-paedophiles-pay-to-watch-webcam-child-sex-abuse-in-philippines)

[3] ECPAT – "SECO Manifestations - Live Streaming of Child Sexual Abuse in Real Time" (http://www.ecpat.org/wp-content/uploads/legacy/SECO%20Manifestations_Live%20streaming%20of%20child%20sexual%20abuse%20in%20real-time_0.pdf)

[4] Beckett, Holmes and Walker (2017) Child sexual exploitation: Definition and Guide for Professionals - Extended text. (Available at https://www.rip.org.uk/resources/publications/practice-tools-and-guides/child-sexual-exploitation-practice-tool-2017-open-access/)

Contents

Executive summary

This Paper introduces the key findings of a study of the distribution of captures of live-streamed child sexual abuse which were publicly available online during 3 months in 2017 ("the Study").

The Study was carried out by Internet Watch Foundation (IWF) and funded by Microsoft. Over a three-month period between August and October 2017, images and videos meeting the research criteria were identified using a combination of leads from existing IWF data and techniques employed by IWF analysts to proactively locate child sexual abuse imagery being distributed online. The images and videos were then assessed in accordance with IWF's standard procedures for processing child sexual abuse imagery. Data captured in each instance included image category[5], site type, commerciality, hosting location, and the assessed age and gender of the individuals depicted.

During the Study, **2,082** images and videos were assessed as meeting the research criteria.

Key findings were:
- 96% depicted children on their own, typically in a home setting such as their own bedroom.
- 98% of imagery depicted children assessed as 13 years or younger.
- 96% of the imagery featured girls.
- 40% of the imagery was Category A or B.
- 100% of the imagery had been harvested from the original upload location and was being redistributed on third party websites.
- 4% of the imagery was captured from mobile-only streaming apps.
- 73% of the imagery appeared on 16 dedicated forums with the purpose of advertising paid downloads of videos of webcam child sexual abuse.

Key recommendations are:
- Recognition of the need for awareness raising programs aimed at educating children and those in a parental role about the risks of live-streaming services;
- Wider implementation of tools to tackle online distribution of child sexual abuse imagery by service providers;
- Development of new services including video hashing technology to detect duplicate captures of live streamed child sexual abuse which have been redistributed online;
- Recognition of legal loopholes facilitating distribution of child sexual abuse imagery and elaboration of policy proposals that can influence positive change.

This paper sets out the limitations on the Study and makes recommendations for further research which can be undertaken to expand upon and clarify the findings. It is hoped that by raising awareness of this issue, a multi-agency approach can be taken to help protect children from the immediate and long-term effects of the distribution of permanent records of their sexual abuse.

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[5] The IWF assess child sexual abuse imagery based on the categories detailed in the Sentencing Council's Sexual Offences Definitive Guideline (see https://www.iwf.org.uk/what-we-do/how-we-assess-and-remove-content/laws-and-assessment-levels). These are set out in full at Appendix B.

Research ethics and treatment of data

IWF did not have direct contact with any of the children depicted in the imagery assessed during the Study. The findings of the Study are based solely on analysis of the imagery and as such an examination of the persuasive influences or coercive measures which resulted in the production of the imagery was outside the scope of the Study.

The terminology and definitions used in the Study were devised with reference to the recommendations set out in the 2016 Terminology Guidelines for the Protection of Children from Sexual Exploitation and Sexual Abuse[6] (commonly referred to as the "Luxembourg Guidelines") and should be interpreted accordingly. For avoidance of doubt, it is beyond dispute that the coercion of children to produce and share sexual content online is a form of sexual abuse.

Irrespective of the circumstances leading to production and subsequent distribution of captures of live-streamed child sexual abuse, the imagery itself is illegal. All images and videos meeting the criteria for inclusion in the Study were separately processed in accordance with IWF's standard procedures for attending to removal of child sexual abuse imagery hosted anywhere in the world. All previously unseen search terms, which were identified during the course of the study as being associated with child sexual abuse imagery, were added to the IWF Keywords List[7].

Whilst in many cases it was not possible to determine the geographical location of the children depicted, there were a number of instances particularly in relation to video content where it was possible to identify the likely country where the individuals were located. Given the global nature of the internet, these locations were diverse. In most cases where it was possible to identify the likely location, the children appeared to be outside the United Kingdom. Where the imagery provided clues to the identity or location of the children depicted, full details were passed to the Victim ID team at the National Crime Agency Child Exploitation and Online Protection Centre (NCA CEOP Command) for further investigation as appropriate.

All data collected for the Study was entered into IWF's bespoke report management system. IWF stores data in compliance with all relevant data protection rules, including the provisions of the UK Data Protection Act 1998.

Consent to carry out the Study was provided by IWF's Ethics Committee in accordance with IWF's Ethics Policy governing research.

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[6] See footnote 1 above.

[7] The IWF Keywords List (IKL) contains over 400 terms known to be associated with online child sexual abuse imagery. The list is provided to IWF Members and can be used to moderate or filter content within their services. The IKL is also available to stakeholders in online child protection including law enforcement agencies and hotlines within the INHOPE network (see www.inhope.org for further information). To be eligible for inclusion in the IWF Keywords List, suspect terms are searched by IWF Analysts using a variety of platforms including web search. Suspect content located using these terms is then assessed in accordance with IWF's standard procedures for taking action on online child sexual abuse material. Only where the content is verified as meeting IWF criteria for assessment as confirmed child sexual abuse material are the terms added to the IWF Keywords List.

Background

There has been much previous research into the creation and distribution of what is often referred to as "self-generated" sexual content featuring children, including in relation to so-called "sexting"[8],[9],[10]. Typically, this research has focussed on prevalence and likelihood of young people to distribute such content, their potential motivations and/or their reactions to receiving such content from their peers rather than the method of production and/or distribution. Research findings vary as to the extent to which such distribution occurs and the potential motivations of the young people depicted, however as noted by Cooper et al (2015) this variation may in part be attributable to inconsistencies in project terminology and research aims[11].

In 2011, in their paper "Sexting: A Typology"[12] Janis Wolak and David Finkelhor presented a typology of "sexting" episodes based on a review of 550 cases obtained from a survey of national law enforcement agencies in the United States of images "created by minors of minors which would qualify as child pornography under applicable criminal statutes". Wolak and Finkelhor proposed a definition of "youth-produced sexual images" encompassing the full range of such incidents that had come to the attention of law enforcement. The study broadly divided these incidents into two categories: "Aggravated" episodes involving criminal or abusive elements (such as adult involvement, criminal or abusive behaviour by minors or extortion/distribution without consent); and "Experimental" episodes in which children exchanged sexual imagery in a romantic context, or for attention-seeking but where there was no criminal behaviour beyond the creation or sending of the images and "no lack of willing participation" by the child. It was noted that whilst some incidents involved children aged 9 years and under, those children did not appear to have sexual motives. "Youth-produced sexual images" included images created or distributed by any electronic technology (i.e. mobile phone, webcam, digital camera). Whilst not specifically confined to youth-produced sexual content which had been distributed online, the findings provide useful insights into the circumstances surrounding the production of imagery of this type in circulation on the internet.

In 2015, the Internet Watch Foundation (funded by Microsoft) carried out a study to examine characteristics of youth-produced sexual content being publicly distributed online[13]. Over a 3-month period in 2014, the researchers captured data based on Wolak and Finkelhor's definition. The study consisted of an analysis of 3,803 instances of "youth-produced sexual content"[14] and included data relating to the age and gender of the individuals in the imagery; the nature of the sexual activity depicted and the extent to which such content had been redistributed from its initial upload location. Where possible to identify, the device used and the service from which the imagery originated was also recorded. The study found that 7.5% of the imagery depicted children aged 10 or younger and that 86% of the content depicting children aged 15 and under had been captured from a live webcam stream. All of the imagery depicting children aged 15 or under was found to have been distributed beyond its original upload location. Therefore, regardless of the circumstances surrounding its initial creation, the imagery was subsequently used to further exploit the children or young people involved.

The findings of IWF in 2015 regarding the age of children depicted in this type of content were supported by the contemporaneous study "Digital Dangers - The impact of technology on the sexual abuse and exploitation of children and young people"[15]. The author of the research explored the experiences of Barnardo's project workers working directly with victims of child sexual exploitation and found that project workers report online abuse as the prominent factor in many of their referrals. A key finding of the study was that age at referral of young people abused online was lower than those referred due to offline sexual exploitation, with children between 10-12 years being "more the norm". The study also highlighted some of the issues surrounding definitions and terminology relating to this type of content. Case workers interviewed for the study spoke of the normalisation of online sexual interaction amongst children. One case worker stated "…the young people think it is normal to send a picture of [their] breasts, it's normal to send a picture of their vagina and that's what we are fighting against as professionals". Others voiced the opinion that, because the children

[8] Phippen, A., 2009. Sharing personal images and videos among young people. Southwest Grid for Learning, Nov. Available at http://webfronter.com/surreymle/devonesafety/other/Sexting%20report%20-%20andy%20phippen.pdf

[9] Lenhart, A., 2009. Teens and sexting. Pew Internet & American Life Project, 1, pp.1-26. Available at http://ncdsv.org/images/PewInternet_TeensAndSexting_12-2009.pdf

[10] Lounsbury, K., Mitchell, K.J. and Finkelhor, D., 2011. The True Prevalence of "Sexting". Available at http://www.unh.edu/ccrc/pdf/Sexting%20Fact%20Sheet%204_29_11.pdf

[11] Cooper, K., Quayle, E., Jonsson, L. and Svedin, C.G., 2016. Adolescents and self-taken sexual images: A review of the literature. Computers in human behavior, 55, pp.706-716.

[12] Wolak, J. and Finkelhor, D., 2011. Sexting: A typology. Available at http://scholars.unh.edu/cgi/viewcontent.cgi?article=1047&context=ccrc

[13] Internet Watch Foundation, 2015. 'Youth Produced Sexual Content Online', Available at https://www.iwf.org.uk/sites/default/files/inline-files/Online-produced_sexual_content_report_100315.pdf

[14] For the purposes of the study a "youth" was defined as an individual assessed as being 20 years old or younger.

[15] Palmer, T., 2015, "Digital Dangers - The impact of technology on the sexual abuse and exploitation of children and young people" Available at http://www.barnardos.org.uk/onlineshop/pdf/digital_dangers_report.pdf

with whom they worked perceive online sexual exploitation as simply normal and not abusive, they were unlikely to report what has happened. As such, reliance on self-report data by children could mean the scale of the issue is not fully recognised.

The Internet Organised Crime Threat Assessment (iOCTA) 2017[16] produced by Europol listed online solicitation and sexual extortion as a key threat in relation to child sexual exploitation online. The report noted that offenders directly solicit or groom children to send sexually explicit imagery or to display themselves live via the internet. The imagery obtained may then form the basis of ongoing sexual or financial extortion of the victims. The report also clearly distinguished commercial "live-distant child abuse" (LDCA), where a child suffers hands-on abuse at the direction of a remote viewer, as a separate function of live-streaming services in online child sexual exploitation.

Similarly, a stakeholder briefing paper distributed in 2017 by Thorn[17], a US based NGO that works to stop child sexual abuse, provided a high-level analysis of data received from law enforcement and child protection agencies relating to child sexual exploitation involving live-streaming services. The briefing highlighted three different functions of live-streaming services in relation to online child sexual exploitation: grooming of victims on social media; rebroadcasting of offender collections; and commercial sexual exploitation live-streamed to remote buyers. In the latter scenario, an adult (or sometimes an older child) carries out the physical abuse of a child at the direction of the remote buyer. The authors noted that in relation to online grooming, offenders may capitalise on a child's desire for belonging or celebrity-like status to facilitate victimisation. This took the form of a "game", where the child was coerced to agree to perform specific sexual acts on receiving "likes". For example, the child may initially agree to sexual posing on receiving 500 likes. As the "game" proceeds, the child may agree to other acts - the higher the number of likes, the greater the victimisation. The authors further noted the propensity for offenders to take permanent captures of these live streams, perhaps for purposes of further blackmail of the victims or for onward commercial distribution of the imagery.

Notwithstanding the circumstances surrounding the initial creation or distribution by children of sexually explicit imagery of themselves, it is vital that the very real risks are recognised and addressed. Such risks extend beyond the online environment. A recent report published by Barnardo's[18] in the UK identified that of the 297 children who had received support via Barnardo's online sexual exploitation services after experiencing online grooming, 182 (61%) had subsequently arranged to meet the person that groomed them in person and suffered contact sexual abuse at their hands.

Ofcom, the independent regulator and competition authority for the UK's communications industry, produces an annual report of children's and parents' media use and attitudes. The Ofcom Children and Parents: Media Use and Attitudes Report 2014[19] reported that laptops/notebooks were the most popular devices used for internet access in the 5-15 year age group, with 66% of children using a laptop or notebook to go online at home. Of the 88% of children aged 5-15 years with internet access at home in 2014, 20% accessed the internet via a desktop, laptop or notebook in their bedroom. This situation was reflected in the findings of the study titled "Youth Produced Sexual Content Online"[20] carried out by IWF in late 2014 and published in March 2015, which found that 86% of the total content involving children aged 15 years or under had apparently been captured from live streaming services broadcast via a laptop webcam, predominantly in a bedroom setting.

The Ofcom Children and Parents: Media Use and Attitudes Report 2017[21] highlighted a change in devices most popularly used by children to access the internet. While 69% of children surveyed still had access to the internet using a desktop, laptop or netbook, children aged 8-11 years increasingly reported that they were most likely to use a tablet to go online, with children aged 12-15 most likely to use a mobile phone. Understanding the ways in which trends in children's use of technology may impact on their risk of online sexual exploitation has important implications for effective intervention.

[16] Interpol Organised Crime Threat Assessment 2017 (https://www.europol.europa.eu/activities-services/main-reports/internet-organised-crime-threat-assessment-iocta-2017)

[17] "Live Streaming_Preliminary Findings" Thorn, 2017 - Briefing paper provided to WeProtect, November 2017, (unpublished)

[18] Barnardos.org.uk, 2016, 'Barnardo's Online Grooming Survey 2016'. Available at: http://www.barnardos.org.uk/resources/research_and_publications/barnardos-online-grooming-survey-2016/publication-view.jsp?pid=PUB-2920.

[19] Ofcom, 2014. 'Children and parents: media use and attitudes report 2014'. Available at: https://www.ofcom.org.uk/research-and-data/media-literacy-research/children/children-parents-oct-14

[20] See footnote 13 above

[21] Ofcom, 2017. 'Children and parents: media use and attitudes report 2017'. Available at https://www.ofcom.org.uk/__data/assets/pdf_file/0020/108182/children-parents-media-use-attitudes-2017.pdf

Purpose of the Study

The Study aimed to examine characteristics of captures of live-streamed child sexual abuse in distribution online.

IWF is in an almost unique position in being able to provide data about the volume and characteristics of captures of live-streamed child sexual abuse in distribution online, including the websites where this content is being displayed. Due to the legal issues inherent in viewing this imagery, there is a lack of research into its online availability, the individuals depicted, the methods of production of the content or the way in which it is being distributed online. As such, the purpose of this Study was to enhance the existing evidence-base, enabling stakeholders working in all aspects of online child protection to facilitate improved service provision.

The questions this Study sought to address were:

1. How do the methods of creation/distribution of captures of live-streamed child sexual abuse, the characteristics of the individuals depicted and the category of the sexual activity depicted vary in relation to the age ranges depicted?

2. Where are captures of live-streamed child sexual abuse being distributed? (Which platforms/site types?)

3. What can be learned from an examination of the characteristics of the individuals depicted and/or the distribution methods of this content which may inform strategies for disruption/intervention?

Definitions

For the purposes of this Study:

- "Captures of live-streamed child sexual abuse" were defined as:

  "Images or videos permanently recorded from a live broadcast stream; in which the child(ren) consciously interacted with a remote other(s); and which met the IWF threshold for action as child sexual abuse material".

  Images or videos where the individual could not clearly be seen interacting with a third party via their webcam were therefore outside the scope of the Study. However, the Study did include still images taken from recordings of live streams which had been previously assessed by IWF and in which it had been identified that the child was knowingly interacting with a remote other via the webcam.

  The IWF assesses child sexual abuse material based on the levels set out in the Sentencing Council's Sexual Offences Definitive Guideline (figure 1).

Category A	Images involving penetrative sexual activity with an animal or sadism
Category B	Images involving non-penetrative sexual activity
Category C	Other indecent images not falling within categories A or B

  Figure 1 - UK Sentencing Council's Sexual Offences Definitive Guideline

- A "**child**" was defined as "**an individual assessed as under the age of 18 years**".

  IWF's standard categories for age assessment of victims depicted in child sexual abuse content are as follows:

  > 0-2 years
  > 3-6 years
  > 7-10 years
  > 11-13 years
  > 14-15 years
  > 16-17 years

  Section 45(1) of the Sexual Offences Act 2003[22] defines a child as anyone under the age of 18 years. However, age assessment in the upper age range can be problematic and IWF therefore requires additional evidence (i.e. police verification of age) to takedown content in cases where the individual depicted is assessed as 16-17 years. As such, for the purposes of the Study, content depicting young people assessed within the 16-17 years age range would only be considered eligible for inclusion if the age and identity could be or had previously been verified in accordance with IWF's standard procedures.

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[22] *Sexual Offences Act 2003*, s 45(1). Available at http://www.legislation.gov.uk/ukpga/2003/42/section/45

Sample

The volume of captures of live-streamed child sexual abuse in circulation online at any given time is currently unknown. Moreover, the volume is constantly changing. Given this limitation, non-probability sampling was the most appropriate approach.

The imagery included in the Study was located using a snowball sampling[23] method beginning with "seed" URLs for investigation. The seed URLs were taken from IWF's historic dataset or located via global market-leading search engines using search terms and keywords used by IWF's Hotline to proactively locate suspected child sexual abuse imagery. All the content included within the Study was online at the time of collection. Each seed URL was manually reviewed to identify imagery meeting the research criteria. Links from these initial "seed" URLs were then followed to locate additional URLs displaying similar imagery. The criteria for inclusion in the Study was that the imagery was assessed as "captures of live-streamed child sexual abuse" in accordance with the definitions outlined above.

As such, the findings of the Study are limited in terms of representativeness. However, snowball sampling is of practical value when seeking to obtain evidence relating to hidden or hard-to-reach populations such as that which forms the basis of the Study[24].

Data Collection

Data collection was carried out during a three-month period from August to October 2017. The data was recorded using IWF's bespoke report management system. Each image was assigned a unique reference number and the information captured included technical and contextual information relating to the image (such as URL, hosting information, commerciality and distribution channel) as well as information relating to the content of the imagery. Where it was possible to identify, information was captured regarding the suspected original provenance of the content.

A full list of the data captured for each of the images/videos assessed appears at Appendix A.

Analysis

Content analysis was performed on the imagery meeting the research criteria, focussing on aspects such as age, gender and category of severity. Information regarding the websites on which the imagery appeared (including site type and hosting location) was analysed to establish any trends or patterns emerging specifically from that data.

All imagery which met the criteria for inclusion in the Study was also separately processed for removal and investigation in accordance with IWF's standard processes for dealing with child sexual abuse imagery hosted anywhere in the world.

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[23] Snowball sampling is a technique often used for analysing online networks. Once a webpage has been identified containing imagery which meets the research criteria, hyperlinks from that webpage are followed to identify further webpages for investigation.
[24] Atkinson, R. and Flint, J., 2001. Accessing hidden and hard-to-reach populations: Snowball research strategies. Social research update, 33(1), pp.1-4.

Results

During the Study, 2,082 image and video captures of live-streamed child sexual abuse (also referred to interchangeably throughout this paper as "imagery") were identified as meeting the research criteria. The majority of the imagery (1,989 / 96%) consisted of still images (typically "grid" images[25]). In 93 instances (4%) it was possible to download full video captures of live-streamed child sexual abuse. The video captures varied in length, with some being of a few minutes duration and others lasting over an hour.
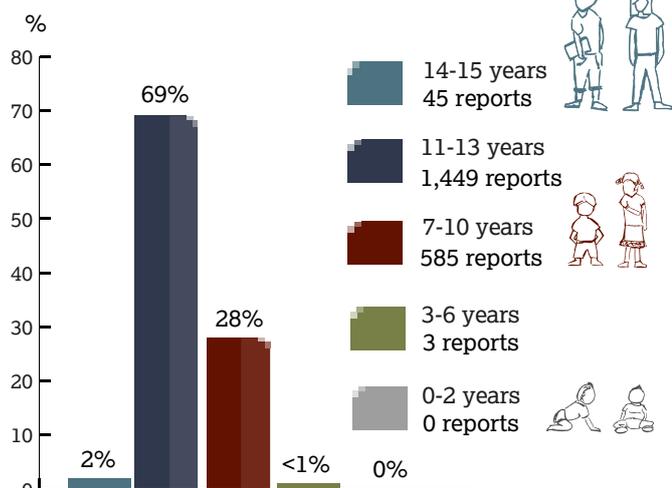
Age of children

Figure 2 - Sampled imagery by age range

Age (years)	No. of reports	%
14-15	45	2%
11-13	1,449	69%
7-10	585	28%
3-6	3	<1%
0-2	0	0%
Total	2,082	100%

98% (2,037) of the images and videos depicted children assessed as 13 years or younger. The majority of the imagery (1,449 / 69%) depicted children assessed as being between 11-13 years of age[26]. 28% (588) of the imagery depicted children assessed as 10 years or younger. As noted above, IWF did not have direct contact with the children depicted in the imagery and in the absence of being able to verify age, none of the imagery which was identified and assessed as depicting children in the 16-17 year age range met the eligibility criteria for inclusion in the Study.
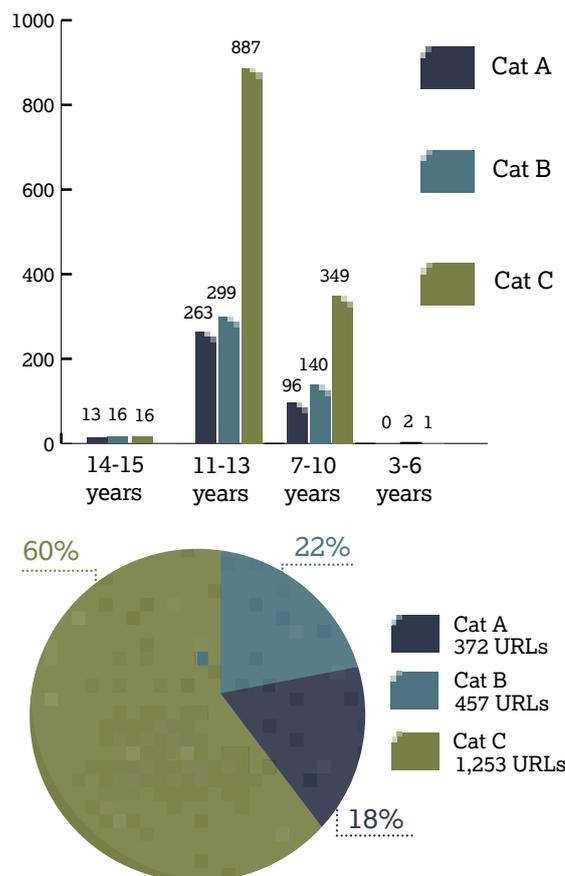
Severity of content

Figure 3 - Severity of sampled imagery by age

Age (years)	Cat A	Cat B	Cat C
14-15	13	16	16
11-13	263	299	887
7-10	96	140	349
3-6	0	2	1
0-2	0	0	0
Total	372	457	1,253

40% (829) of the images and videos were at the higher levels of severity (Category A or B) with 18% (372) assessed as being Category A. Category A is the highest level of severity depicting penetrative sexual activity; sadism; or bestiality; involving children. For example, imagery which depicted children penetrating themselves or other children with objects (genitally or anally) was therefore included within this category. Category B relates to non-penetrative sexual activity involving children and, for example, included images or videos which depicted children masturbating themselves or other children. Images and videos were assessed as falling within Category C where there was a specific focus on the child's naked genitalia, which typically involved the child deliberately presenting their naked genitalia close to the webcam.

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[25] A grid image is a single image which consists of a series of still images captured from a video, arranged in a grid format. A number of free software tools are available which perform this function.
[26] Where the age of the child was assessed as being on the cusp between two age ranges, the higher age range was chosen.
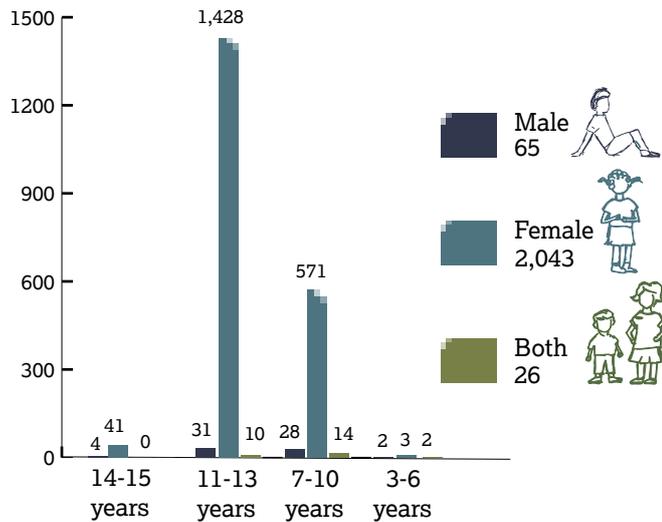
Gender

Figure 4 - Gender by age range

Age (years)	Male	Female	Both
14-15	4	41	0
11-13	31	1,428	10
7-10	28	571	14
3-6	2	3	2
0-2	0	0	0
Total	65	2,043	26

Images and videos depicting one or more girls represented 96% of the images in the sample. Boys appeared in 3% of the images and videos, with 1% of the imagery featuring 2 or more children of both genders.

Lone children

It was of interest to note that none of the imagery identified in the Study included the physical presence of an adult. IWF's standard procedure for assessing age is that the data captured where one or more children of differing age groups appears relates to the lowest age group depicted in the content. For the purposes of this Study, a more detailed analysis was undertaken to capture whether the child depicted was alone and, in cases where multiple children were depicted, the age range of all those present was assessed and recorded.

Of the total images and videos, 2,003 featured children who were physically alone at the time the content was created. Typically, the victims were in their bedroom or a bathroom with the door closed, apparently within a home environment. In one case, the victim at intervals turned her attention from the webcam to engage in routine conversation with a parent who was outside the room. The following table shows a breakdown of lone children by age and category.
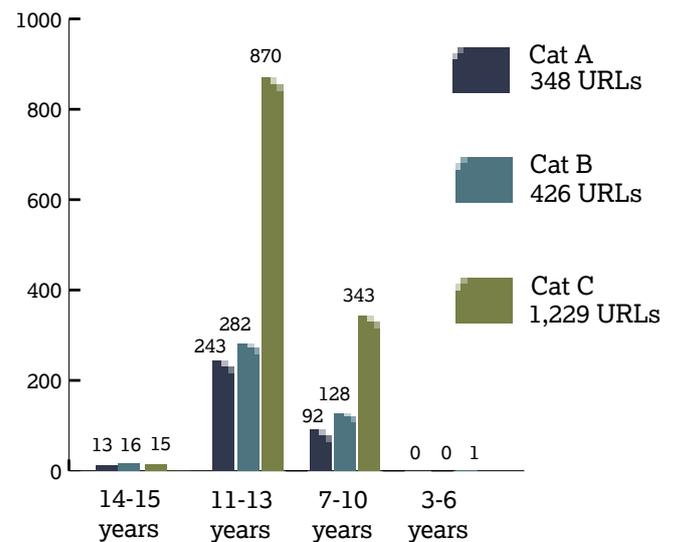

Figure 5 - Content featuring lone children in each category by age

Age of lone child	Category A	Category B	Category C
14-15	13	16	15
11-13	243	282	870
7-10	92	128	343
3-6	0	0	1
0-2	0	0	0
Total	348	426	1,229

Multiple children

Of the total images, 79 depicted multiple children. Of these, 6 depicted children aged 10 or under with at least one older child assessed as being aged 11-13 years. In 73 cases, the imagery depicted two or more children all assessed as being within the same age range. As with lone children, the imagery was typically broadcast from a home setting such as a bedroom or bathroom and with no adult physically present.

Distribution methods

The 2,082 images and videos were located across 78 different domains. The site type of each URL was categorised as in the table below. A full glossary of the site types appears in Appendix C.
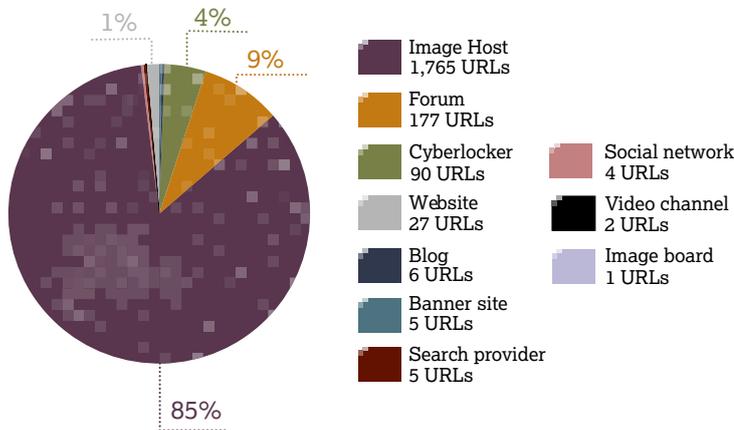

■	Image Host 1,765 URLs
■	Forum 177 URLs
■	Cyberlocker 90 URLs
■	Website 27 URLs
■	Blog 6 URLs
■	Banner site 5 URLs
■	Search provider 5 URLs
■	Social network 4 URLs
■	Video channel 2 URLs
■	Image board 1 URLs

Figure 6 - Site type where sampled imagery located

Site type	No. of images / videos
Banner site	5
Blog	6
Cyberlocker	90
Forum	177
Image board	1
Image host	1,765
Search Provider	5
Social network	4
Video channel	2
Website	27
Total	2,082

The majority of the imagery (1,765 / 85%) was stored on an image host website. Image hosts allow users to upload still images which are assigned a unique URL and can be embedded to display on third party websites, such as forums or social networking sites. This technique is commonly employed to distribute child sexual abuse images. In 2017, 69% of the child sexual abuse images actioned by the Internet Watch Foundation was hosted on image host websites[27]. By using Image Hosts distributors of child sexual abuse imagery exploit legal loopholes which exist outside of the UK, ensuring their core websites remain online and immune to takedown.

Further analysis of this data identified that of the 1,765 images being distributed via Image Hosts in this Study, 1,526 (86%) of these had been embedded into 16 forums dedicated to distribution of captures of live-streamed child sexual abuse. The implications of this finding are discussed in detail in later sections.

Provenance of the images/ videos

All the images and videos had apparently been harvested from the original upload location and were being distributed on third party websites. This could be deduced by reference to watermarks/branding embedded in the imagery by the originating website and by reference to the image name or associated text. Where identifying information appeared in conjunction with the image (for example, specific usernames) attempts were also made to locate and capture the imagery on the originating website. In all such cases, the children's user accounts had already been removed from the originating service, illustrating the loss of control over redistribution of this content once it has appeared online.

In several cases it was possible to deduce that the image/video had been harvested from its original upload location but it was not possible to state which site the content originated from. For example, text on particular sites claimed to contain a round-up of recent content appearing on popular social networks but did not identify the sites from which the content had been taken. However, where it was possible to ascertain, the original provenance of the content assessed was captured. The suspected original provenance of the content was deduced in several ways, including:
- Branding embedded onto the content by the source website;
- The domain name or URL of the website on which the content was displayed, which featured the name of the source website;
- The filename of the imagery (where it may be a combination of the name of the source website and/or the username used by the individual depicted on the source website);
- Text appearing in conjunction with the imagery which indicated the source website.

Of the 2,082 images and videos assessed, 436 (21%) contained indications of the original provenance. These 436 images and videos appeared to have been harvested from 18 different live-streaming services, including social networks, chat sites, and mobile apps.

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[27] Internet Watch Foundation Annual Report 2017 available at https://www.iwf.org.uk/report/2017-annual-report

Mobile live-streaming apps accounted for 4% (90) of the images and videos. In some cases, it was evident that children were being coerced into sexual activity in order to gain "likes" or comments from viewers. One child, who gave her age as 12 years old, referred to having 50 viewers to her current broadcast stream. After repeatedly exposing herself to the webcam, she stated that she would stop the broadcast if people didn't start commenting or "liking" the stream as there would be "no point" in her continuing.

Children appearing in captures of live-streamed child sexual abuse

The finding that 98% of the imagery in the Study depicted children assessed as being 13 years old or under provides support for the findings of Palmer (2015)[28] regarding age of children suffering online sexual abuse and highlights the nature of live-streamed child sexual abuse. Further, the finding that 28% of children depicted were aged 10 or under appears to provide support for the findings of IWF's 2015 study that younger children are also becoming victims of live-streamed child sexual abuse.

Whilst IWF is aware that some of the material assessed had been in existence for several years, there were also several instances where the content had apparently been created within the past 6-12 months. The approximate length of time the imagery had been in existence may be apparent because, for example, certain services are no longer in existence, or have been recently launched.

In many instances, the children depicted in the imagery took no steps to conceal their identity or location, even in some cases using their real names. Ofcom's 2017 Report[29] on children's media use and attitudes indicated that while 82% of 12-15 year olds would take steps to try and verify that a website was trustworthy before they first used it, 53% of children in this age range agreed with the statement "I can easily delete information that I have posted about myself online if I don't want people to see it". However, 100% of the Study imagery had been harvested from its original upload location and further distributed via third party websites, so control over its removal or onward distribution had been lost. Whilst a number of initiatives are in place to educate older children and parents about the risks associated with the production and distribution of images in the context of "sexting", this finding suggests there is still a lack of awareness amongst children of the risks of live interactions via webcam and the potential for permanent records to be created and distributed outside of their control.

Additionally, the finding that 588 (28%) of children were assessed as being 10 years old or younger demonstrates the need for awareness-raising initiatives aimed at primary age children regarding the permanence of content distributed online and the potential for loss of control over its removal and onward distribution.

In support of the trends reported in 2017 by Europol[30] and Thorn[31] , the Study identified captures of live-streamed child sexual abuse which fell into the "grooming" category. In several cases it was apparent that the child was being coerced as part of a "game of likes" for which the children received rewards. It is possible that some of the imagery identified within the Study may have been created during "rebroadcasts" of content by offenders and then further distributed.

However, in contrast, no imagery was identified which appeared to fall into the category of content encompassed by the terms "commercial sexual exploitation live-streamed to remote buyers" and "live-distant child abuse" as no adults were present in any of the imagery. Whilst the possibility cannot be discounted that in the 6 cases where an older child appeared engaging in sexual activity with a younger child, the imagery may have fallen into this category, the volume of such imagery encountered during the Study was low. The reason for this is unknown. It is possible that given the higher direct financial cost of producing this type of child sexual abuse material, it is not in such widespread public distribution online and is instead distributed through private networks; or that in such situations a permanent capture of the content is less likely to be made. There is a lack of data regarding the extent to which permanent captures of "live-distant child abuse" appear in offender collections and, whilst outside the remit of IWF, examining the extent of distribution of this type of imagery could form the basis of future research to identify opportunities for intervention. For example, whilst the limitations on this Study are acknowledged, given the apparent scarcity of captures of "live-distant child abuse" in public distribution online the possession of this type of content may have implications in the risk assessment of offenders which are worthy of consideration.

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[28] See footnote 15 above
[29] See footnote 21 above
[30] See footnote 16 above
[31] See footnote 17 above

Distribution Methods

Of the 1,765 images being distributed via Image Hosts in this Study, 1,526 (86%) had been individually embedded into 16 forums dedicated to distribution of captures of live-streamed child sexual abuse. As the following diagram shows, these forums are at the centre of distribution networks for captures of live-streamed child sexual abuse.
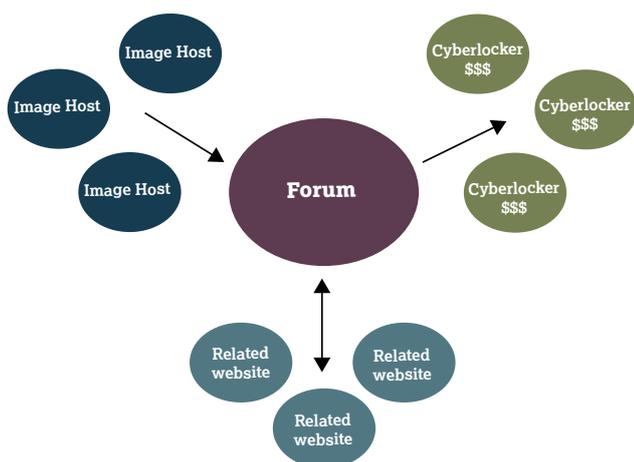

Figure 7 - Distribution network for captures of live-streamed child sexual abuse

The embedded "grid" images[32] were being used on these forums to advertise paid downloads of the full video capture of live-streamed child sexual abuse from third party cyberlocker sites. Such cyberlockers pay the uploaders of content for each sign-up and subsequent download of their files. This technique arguably represents commercial use of the imagery, as the uploader profits financially each time one of these video files is downloaded[33].

IWF does not have the remit to pass payment barriers to proactively locate child sexual abuse imagery. As such, whilst each of the 1,526 images embedded into child sexual abuse forums dedicated to distribution of so-called "jailbait" imagery was associated with a link to download the corresponding video from a third party cyberlocker, it was only possible to download and assess the video in 60 cases where the cyberlocker and/or uploader had enabled a "free trial" download. In each of these cases, the video corresponded to the image which was being used to advertise the download and was assessed as a capture of live-streamed child sexual abuse. In all other cases, the cyberlocker displayed a page indicating that the video was available only to "premium" members. Comments posted by other users on the forums concerned indicated that

these "premium" downloads did indeed contain a video capture of webcam child sexual abuse which corresponded to the grid image used to advertise it. IWF is unable to take action to remove child sexual abuse imagery from cyberlockers where it is not possible to download and manually verify the file. The use of paid cyberlocker accounts therefore not only frustrates removal of captures of live-streamed child sexual abuse at source but enables offenders to make a direct financial profit from its distribution. However, a number of solutions are available to service providers which would enable them to more effectively prevent this misuse of their services. By implementing existing solutions such as keywords lists and image hash lists, service providers can be proactive in disrupting the distribution of all forms of child sexual abuse imagery within their networks and ensure victims are better protected from revictimization and further exploitation.

Provenance of images and videos

Any online service which allows user-generated content is potentially open to abuse by those with a sexual interest in children. However, service providers should not be complacent about this issue. Services which are persistently targeted by offenders for the creation of captures of live-streamed child sexual abuse commonly become "keywords" which can then be used by offenders to seek out child sexual abuse imagery online. Apart from the obvious harm to child victims, this has implications for brand integrity and future growth and any business which is serious about corporate social responsibility should ensure it is taking all available steps to protect children using its services.

The services identified within this Study are not listed in this paper as to do so may appear to not only imply that any service not listed is "safe" but also provide a roadmap for offenders to seek this content. Instead, IWF works directly with services which have been identified as targets to raise awareness and provide tools to assist in preventing this abuse of their services. Where appropriate, this intelligence may also be shared with relevant stakeholders.

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[32] See footnote 25 above.

[33] European Financial Coalition, 2014. 'Strategic Assessment of Commercial Child Sexual Exploitation Online' (p7) Available at https://www.europol.europa.eu/publications-documents/commercial-sexual-exploitation-of-children-online

Limitations of the Study

Research based on online content analysis is limited as to the extent to which it can be replicated. The internet is extremely dynamic and this is particularly the case with websites dedicated to child sexual abuse material. Additionally, to publish the terms used within the Study to proactively locate child sexual abuse material is problematic in that it, too, provides a roadmap for offenders seeking this content online. Requests for further information regarding the exact search terms employed will be considered by IWF's Ethics Committee on a case by case basis.

Whilst in certain instances information may be available within the images and videos which may provide indications in individual cases, there were several questions relating to captures of live-streamed child sexual abuse which fell outside the scope of the Study.

These questions include:

- The general motivations of children in creating and distributing sexual content, particularly the extent to which they have been coerced or persuaded to do so;
- Whether the children are aware that a permanent recording of their activity is being made.

As noted above, the volume of captures of live-streamed child sexual abuse in circulation online at any given time is unknown and the volume is constantly changing. As such, the prevalence or incidence of such imagery in distribution online cannot be extrapolated from this data. The Study used a convenience sample comprised of lists of target suspect URLs for assessment created using techniques employed by IWF Hotline for proactively locating suspected child sexual abuse imagery. As a result, the findings of the Study are by necessity limited in terms of representativeness. However, IWF is in an almost unique position in being able to gather data on trends in child sexual abuse material online and it is believed that the findings, whilst not generalizable, provide important insights into the current landscape of distribution of captures of live-streamed child sexual abuse online and form a basis for further research.

The nature of the sampling method used arguably introduces some bias, in that in the majority of cases the initial URLs located provided access into networks dedicated to distributing similar content (see discussions of Distribution Methods above). However, the terms used to initially locate these networks were gender-neutral or equally weighted between terms relating to girls and boys. Despite this, only one forum dedicated to the distribution of captures of live-streamed child sexual abuse featuring boys was located. That forum was located within the Tor network, which facilitates anonymous connections[34]. The remainder of the identified forum networks were located on the open web. One of these forums contained a mix of content depicting boys and girls, however the majority of the content depicted girls. The remaining forums identified were dedicated to distribution of webcam child sexual abuse depicting girls. Whilst the findings are not generalizable, they are broadly consistent with overall published figures of child sexual abuse imagery publicly available online, which suggest approximately 80% of such content features girls[35],[36]. Whilst outside the scope of this Study, the findings raise questions regarding differences in distribution and consumption of child sexual abuse imagery based on victim gender which may have implications for effective intervention and/or disruption and highlight the need for further research.

The limitations on the Study certainly do not invalidate or undermine the value of the findings, but are explicitly set out to explain the decisions made regarding design and methodology and how the findings should be interpreted.

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[34] See www.torproject.org for further information about the Tor proxy network.
[35] Canadian Center for Child Protection, 2016. 'CHILD SEXUAL ABUSE IMAGES ON THE INTERNET : A Cybertip.ca Analysis'. Available at: https://www.cybertip.ca/pdfs/CTIP_CSAResearchReport_Summary_2016_en.pdf
[36] Internet Watch Foundation, 2016. 'Annual Report 2015'. Available at https://www.iwf.org.uk/report/2015-annual-report

The Study identified several opportunities for stakeholder action to prevent and respond to online distribution of captures of live-streamed child sexual abuse. Key recommendations are as follows.

Creation of awareness programs aimed at parents and younger children regarding the risks of online streaming services

Whilst a number of initiatives are in place to educate older children and parents about the risks associated with the production and distribution of images in the context of "sexting", this Study suggests there is still a lack of awareness amongst children of the risks of live interactions via webcam and the potential for permanent records to be created and distributed outside of their control. Additionally, these findings demonstrate the need for awareness-raising initiatives aimed at primary age children regarding the permanence of content distributed online and the potential for loss of control over its removal and onward distribution.

It is recommended that stakeholders working in online child protection seek to implement initiatives which better inform parents, and children of all ages, of the short-term and long-term risks of live interactions via webcam.

Wider implementation of existing solutions to tackle online distribution of captures of live-streamed child sexual abuse by service providers

This Study identified an emerging trend for captures of live-streamed child sexual abuse to be collected on dedicated forums and distributed for the purposes of financial gain. The 16 forums identified in the Study which were dedicated to distribution of child sexual abuse imagery were using captures of live-streamed child sexual abuse to advertise paid downloads of associated video content from third party cyberlocker services. There are often no indications given on the cyberlocker site which would provide an indication of the content of the download and the service may therefore be completely unaware that it is hosting such child sexual abuse imagery.

It is recommended that cyberlocker services take positive action to counter this misuse of their services by using keywords lists and image hash[37] lists to identify and remove such content.

It is also recommended that the payment services industry effectively partners with all available sources of intelligence to ensure it is not inadvertently facilitating the commercial distribution of child sexual abuse imagery by continuing to provide payment services to cyberlocker or file hosting sites which are unwilling to take these steps.

Development and implementation of new solutions including video hashing technology to detect captures of live-streamed child sexual abuse

Offenders publicly distributing captures of live-streamed child sexual abuse online are exploiting premium-only cyberlocker services to monetise such distribution and to frustrate removal of videos at source.

The use of image hash lists using Microsoft's photoDNA are an effective tool to prevent the upload and/or detect distribution of duplicates of child sexual abuse images in online services. Whilst a number of solutions are in development, to date there is no similar industry standard for the detection of duplicative video content. The development of an industry standard method for hashing videos of child sexual abuse would enable videos being redistributed within cyberlockers to be quickly identified and removed by the providers of these services.

Internet Watch Foundation is currently working with Microsoft to develop an industry standard enabling a list of video hashes to be created. Partnering with IWF to implement new solutions will better enable organisations within the internet industry to combat the redistribution of videos of live-streamed child sexual abuse online.

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[37] An image "hash" is a unique string of characters generated from the binary data of a picture or video and/or biometric information within a picture. Hashing algorithms such as Microsoft's photoDNA ensure images can be identified using the hash even if the original image has been resized or altered. (http://news.microsoft.com/presskits/photodna/)

Recognition of legal loopholes facilitating distribution of webcam captures of child sexual abuse and elaboration of policy proposals that can influence positive change

By exploiting legal loopholes which exist outside of the UK, the distributors of captures of live-streamed child sexual abuse are able to ensure the websites distributing this content remain live for long periods, leaving the children depicted vulnerable not only to potential negative attention from those within their peer group but also to recurring revictimisation by the individuals who are collecting and distributing this type of material across the wider internet.

It is recommended that further research should be undertaken to 1) identify the legal loopholes that allow for the distribution of captures of live-streamed child sexual abuse and 2) inform policy proposals aimed at tackling such loopholes and influencing positive change.

Conclusions

The findings of the Study provide an updated snapshot evidencing changing trends in methods of production and distribution of captures of live-streamed child sexual abuse. Despite an increasing awareness of the issue the online distribution of this imagery continues to be of serious concern.

IWF will continue to work with online services which are misused to distribute child sexual abuse imagery, those working in online child protection and members to raise awareness of current trends and innovate new strategies to disrupt distribution of captures of live-streamed child sexual abuse. However, this complex global issue requires multi-stakeholder action if it is to be effectively addressed. It is hoped that the recommendations made in the Study will benefit stakeholders working in all aspects of online child protection and provide the basis for innovating strategies to prevent and respond to the issue of live-streamed child sexual abuse.

Further research

As reported by OFCOM in November 2017[38], children aged 8-11 years are now most likely to use a tablet to go online, with children aged 12-15 most likely to use a mobile phone. The finding that 4% of the captures of webcam child sexual abuse identified in the Study originated from mobile-only streaming apps appears to reflect these changing trends in children's use of technology to access the internet. It is therefore recommended that this Study be repeated on an annual basis to continue to map trends in the creation and distribution of this type of content.

Any future studies by IWF should be expanded to incorporate some or all of the following research questions:

• What effect do changes in technologies used by children to access the internet have on the methods of creation/distribution of captures of live-streamed child sexual abuse online?
• Using hash[39] technology, can it be established to what extent the same captures of live-streamed child sexual abuse are duplicated across multiple third party websites?
• Where the same imagery is duplicated across multiple third party websites, is it possible to map the journey taken by the content to indicate possible strategies for intervention and disruption of its distribution?

Additionally, whilst such future research is outside the remit of IWF, it is proposed that future research could also examine the reasons why girls are more likely than boys to appear in child sexual abuse imagery being publicly distributed online. Such research may inform strategies for intervention and disruption by all stakeholders involved in preventing child sexual exploitation online.

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[38] See footnote 20 above
[39] See footnote 37 above

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Appendix A

Full List of Data Types Captured

Date/Time Assessed

Content URL

URL type

IP address

Netname

Hosting country

Netblock information

Domain registration information

Content type

Availability of site

Site type

Site purpose (Commercial/Non-commercial)

Payment information

Category of content

Age of individuals depicted

Gender of individuals depicted

Ethnicity of individuals depicted

Provenance of content

Device used

Number of children depicted

Appendix B

Sentencing Council's Sexual Offences Definitive Guideline.

The section on Indecent Photographs of Children (page 75) outlines the different categories of child sexual abuse imagery:

Category A   Images involving penetrative sexual activity; images involving sexual activity with an animal or sadism

Category B   Images involving non-penetrative sexual activity

Category C   Other indecent images not falling within categories A or B

Appendix C

Glossary of site types

Banner site
A website/webpage made up of adverts for other websites with text links or images which take you to third-party websites when you click them.

Blog
A blog is a discussion or informational site and consists of discrete posts usually displayed in reverse chronological order. A typical blog combines text, images, links, web pages and other media related to its topic.

Cyberlocker
A file hosting service, cloud storage service or other online file storage provider. Cyberlockers are internet hosting services specifically designed to host users' files.

Domain
A collection of resources (such as webpages) which are all organised under a single name. For example, the webpages www.iwf.org.uk/report, www.iwf.org.uk/hotline and www.iwf.org.uk/members are all part of the same domain – namely www.iwf.org.uk.

Forum
A forum is an online community where people hold discussions or exchange content in the form of posts. Forums may hold several sub-forums relating to different topics. Within each topic, new discussions are referred to as threads.

Image board
A type of internet forum that operates through the posting of images. Also sometimes referred to as "chan boards" or "chans".

Image Host
A service which allows users to upload images which are then available as a unique URL. This can then be used to make inline links or embed on other websites, forums, and social networking sites.

Video Channel
A video channel is a website primarily dedicated to hosting videos, which can be played on the website itself without the need to download the content

Website
A traditional static site consisting of images and interlinked pages hosted on a single domain.

Appendix D

About the Internet Watch Foundation

The Internet Watch Foundation (IWF) is the UK-based hotline with a remit to minimise the availability of child sexual imagery hosted anywhere in the world.

IWF provides an anonymous reporting portal for individuals who may have stumbled across child sexual abuse imagery online. IWF analysts also have the remit to proactively seek child sexual abuse imagery online to attend to its removal. IWF is a not-for-profit organisation supported by the global internet industry and the European Commission.

Further information is available at www.iwf.org.uk.

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