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Economics and Regulation of Adult Online Content

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Abbreviations

P2P peer-to-peer

DSA Digital Services Act

VLOP Very Large Online Platform

CSAM child sexual abuse material

NCSM non-consensually shared intimate material

AMAR average monthly active recipient

Economics and Regulation of Adult Online Content

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Abstract

Pornographic websites represent a significant component of the digital ecosystem; however, comparatively limited research has been conducted on this subject in comparison to other websites. This paper aims to gather and enrich the extant literature on the subject. For this purpose, a comprehensive analysis of the diverse business models is conducted, regarding factors such as their design, content uploaded and revenue generation. Furthermore, an analysis of the market structure of the various companies operating within this sector is undertaken, which reveals a high degree of vertical and horizontal integration, with several tube websites as well as websites employing interactive models demonstrating particular significance. The utilisation of such services is frequent across the population, which raises several societal concerns. These include the presence of illegal content such as copyright-infringing material, child sexual abuse material (CSAM) and non-consensually shared intimate material (NCSM), potential issues regarding the protection of privacy, potential negative effects due to harmful material, access by minors and potential negative effects on the mental health. Several potential mitigation measures are presented and current approaches outlined, including age verification, verification of uploaders and performers, content moderation and changes in functionality. Especially tube websites appear to have little intrinsic motivation to remove illegal content and should therefore be examined more closely.

Keywords: Online Pornography, Adult Entertainment, Societal Issues, Digital Services Act (DSA)

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1 Introduction

The advent of the internet has brought about a profound transformation in numerous facets of human interaction and commercial activity, with the adult entertainment industry being no exception. The adult entertainment industry has become a significant presence in the digital economy, as evidenced by its ranking among the most visited websites (Semrush, 2024). Nevertheless, a less extensive corpus of research has been conducted on this subject than on other types of popular websites, although this is gradually changing. This may be attributed to the stigma that is associated with the topic of pornography. The advent of pornographic platforms has not only influenced user consumption habits but has also given rise to a number of societal and regulatory questions. This is evidenced by the classification of four pornographic websites as Very Large Online Platforms (VLOPs) under the Digital Services Act (DSA) of the EU, which has resulted in them being subject to more rigorous requirements than smaller platforms, such as regular risk assessments and subsequent risk mitigation.

The DSA, which aims to foster a safer digital environment and enhance accountability for online services, outlines a range of requirements for various types of intermediary services, including hosting services. Given that a considerable proportion of pornographic websites are based on user-generated content, they are consequently subject to the provisions of this legislative framework. These requirements regarding transparency, risk assessment and risk mitigation are particularly pronounced in the case of the VLOP. However, in order to gain a comprehensive understanding of the relationship between the DSA and pornographic platforms, including potential future developments, it is essential to have a detailed understanding of the current circumstances in this market.

This paper thus analyses in Chapter 2 the various business models employed by pornographic websites, including their design and operational structure, as well as the methods through which they generate revenue. This is followed by an overview of the market, including an examination of the major companies active in the pornographic website market and an analysis of the general market dynamics. Furthermore, Chapter 3 also analyses the most relevant websites, with a particular focus on the EU. In Chapter 4, an overview of the user base of pornographic websites is provided in order to supplement the analysis with a perspective on the demand side of the market. Subsequently, Chapter 5 addresses societal concerns associated with the previously discussed market of pornographic websites. These concerns are classified according to the different risk categories outlined in the DSA. This overview identifies problematic areas that require attention, particularly by the pornographic VLOPs. Chapter 6 presents potential solutions that might diminish the harms of the presented problems and examines the current practices of a subset of pornographic websites. Chapter 7 concludes.

2 Business models

In the early 2000s, the consumption of online pornography was mainly facilitated through pay sites of the pay-per-view or subscription type and through peer-to-peer (P2P) communities (Tyson *et al.*, 2016; Alilunas, 2021). However, a number of factors contributed to the economic decline of the pay sites, including the involvement of some sites in fraudulent activities, the global economic downturn of 2008, concerns about the traceability of online payments, and the emergence of free tube sites (Darling, 2013). Furthermore, the utilisation of P2P networks for accessing pornographic content has also experienced a decline over time. To illustrate, in 2007, P2P networks constituted the largest source of internet traffic, accounting for an estimated 69% of traffic in Germany and on the most widely used P2P networks at the time, BitTorrent and eDonkey, around 18.5% and 15.5% of the files shared were pornographic videos and images (Schulze and Mochalski, 2007). Nevertheless, by 2008, the significance of these networks had already diminished in a number of geographical regions; in Germany, for instance, the proportion of traffic accounted for these networks decreased to 53% (Schulze and Mochalski, 2009). In addition, the proportion of pornographic files shared via the most prevalent P2P protocol, BitTorrent declined by 45% in Germany between 2007 and 2008, partly reflecting the growing popularity of tube sites, which allow users to view content without downloading it (Schulze and Mochalski, 2009).

This decline in relevance has persisted in subsequent years, such that the highest importance is now attributed to different business models. The illicit downloading of pornographic material from dedicated websites persists, albeit to a lesser extent. However, this practice is not addressed in the following discussion, as the focus is on the range of legal websites.

2.1 Tube websites

In 2006, the first tube websites emerged on the online pornography market, with some of the most popular tube websites today, Pornhub, XVideos and xHamster, all being founded in 2007 (Tyson *et al.*, 2016; Rodeschini, 2021; Adib *et al.*, 2021). Subsequently, the tube sites have accumulated a significant volume of demand and have become the predominant source of adult online content over the past decade (Vallina *et al.*, 2023a). Initially, these sites focused more on communication and information technology and less on pornography per se (Le and Penin, 2017). Consequently, the graphic design and technological system that underpin these tube sites are highly sophisticated, comprising a well-developed data collection and analysis apparatus that refines algorithms and facilitates efficient database management and video streaming, thereby increasing profits (Keilty, 2018).

Design

The design of the platform is inspired by the popular video-sharing platform YouTube.

It allows users to upload their own content, view other users' content free of charge, like and comment on uploaded content, create their own profiles and interact with other users. The typical site designs comprise a landing page of recommended content, often reflecting the most recently popular content, arranged in a multitude of rows and columns displaying thumbnails and titles of pornographic videos. Upon hovering the cursor over one of these videos, an animated gif representation of video excerpts is shown. The design provides the user with a sense of control and guidance through the carefully organised videos, while simultaneously creating a sensory overload and a sense of empowerment through the animation that commences when the cursor is positioned over the thumbnails, which encourages the user to persist in their search for lucky finds (Keilty, 2018). Additionally, users are able to utilise the site's menu and search bar in order to browse videos according to their preferred categories, creators, and other criteria. In addition, some websites provide supplementary sections such as pornographic photos.

Uploader

The majority of videos uploaded to tube sites are created by third-party content creators (MacDonald, 2019). These include individual creators who upload their own videos, subscription-based/premium websites that upload some of their content, but also users who upload pirated content. In addition, although not a significant proportion, tube sites also host some original, partner-sponsored content (MacDonald, 2019). In 2017, only 20% of videos on the tube site Pornhub were uploaded by individuals non-affiliated to a commercial organisation (Bridges, 2019).

When uploading videos to tube sites, the uploader can generate income by receiving a share of the advertising revenue generated by their video. This share is dependent on the number of views the video receives and the performance of the advertisements depicted within it, which is dependent on a number of factors, including the number of clicks, the user countries, and the number of sales made (Pornhub, g; xHamster, b). On two of the most popular tube sites, Pornhub and XVideos, this figure is greater than 80% and 50%, respectively (Pornhub, g; Sheer). In 2018, the average revenue per 1,000 views for an uploader on Pornhub was \$0.64 (Pornhub, g), with the mean and median number of views being approximately 165,000 and 35,500, respectively (Yu *et al.*, 2019). Accordingly, revenues of \$105.60/\$22.40 were to be expected for videos with an average/median number of views.

Although this income, in conjunction with the intrinsic motivation to share, may be sufficient to motivate some amateurs to upload their content, many, and potentially the most sophisticated, utilise the uploaded clips to promote alternative sources of income (Raustiala and Sprigman, 2019; Alilunas, 2021). For individual creators, this could be income from other adult sites or social media. Conversely, premium sites may upload some of their normally paid-for content as a loss leader, with the objective of attracting users of tube sites to their paid-for site (Raustiala and Sprigman, 2019; Darling, 2013). The utilisation of tube sites as an advertising platform offers the advantage of reaching a

vast user base, while simultaneously avoiding the expenditure associated with bandwidth and hosting (Darling, 2013). Furthermore, tube sites have the potential to realise greater economies of scale in reducing their hosting costs than premium sites (Darling, 2013). The motives for uploading copyright-infringing content are diverse and complex. They may be financial, social or personal (Janak, 2011; Thomson *et al.*, 2018; Brown, 2014). Nevertheless, the precise motivations behind the uploading of pirated pornographic material remain less well-documented than those behind other forms of digital piracy (Brown, 2014).

Provider revenue

The monetisation strategies employed by tube site providers can be broadly categorised into four main areas: advertising, data collection, paid premium features and, in the case of those who also own other, fee-based adult sites, conversion of users from tube sites to paying customers (Rodeschini, 2021; Raustiala and Sprigman, 2019; McVey *et al.*, 2022). Additionally, affiliate programmes can be a source of revenue for smaller tube sites. These programmes are linked to larger pornographic sites and provide smaller tube sites with financial compensation for directing traffic to the affiliate programme's linked sites.

The major tube sites, Pornhub, XVideos and xHamster, all use a single advertising company, TrafficJunky, Traffic Factory and TrafficStars, to serve their advertisements¹. By gathering data regarding user behaviour on the website, the tube sites are able to infer the preferences of their users and utilise this information to more effectively target their advertisements, thereby increasing their advertising revenue (Alilunas, 2021; Rodeschini, 2021; Raustiala and Sprigman, 2019). Moreover, as numerous owners of tube sites also possess other adult websites or production studios, they employ the collected data to tailor their production or collection of pornographic videos to the inferred preferences, particularly those of individuals most likely to pay for pornography, which enables them to reduce the risk of failure and increase their profit (Raustiala and Sprigman, 2019; Alilunas, 2021; Saunders, 2020). Furthermore, the data itself also constitutes a good (Alilunas, 2021).

2.2 Webcamming websites

Webcamming websites have constituted a noteworthy component of the digital pornography ecosystem for more than ten years (Darling, 2013). It has been postulated that the prevalence of pirated pornographic film material has, at least in part, contributed to the emergence of more interactive business models and experience goods such as webcamming, which are less susceptible to piracy (Darling, 2013; Raustiala and Sprigman, 2019; Patella-Rey, 2021). Additionally, the emergence of technical capabilities may have been a

¹This can be observed in two ways: by being redirected from the tube site to the respective advertising service or, in the case of xHamster, by the advertiser claiming to be the exclusive partner (TrafficStars).

contributing factor (Darling, 2013).

Mode of operation

The design of webcamming sites is similar to that of tube sites. The thumbnails of streams are organised in rows and columns. In some cases, hovering over the thumbnail will play a snippet of the performance, although this is not a universal feature, and on some sites, the thumbnails are even pixelated to prevent users from viewing the content without an account. Additionally, webcamming sites let users filter live streams by creator, content or other criteria.

Webcamming streams comprise one or more individuals engaged in interaction with remote viewers, with the number of viewers ranging from one to several thousand, contingent on the popularity and type of the stream (Patella-Rey, 2021). Such interactions are conducted through video, audio, and text. A distinction is frequently drawn between public and private shows, with the former being accessible to an unlimited number of people and the latter being accessible only to a few or even just one person (Sanders *et al.*, 2018). Some webcamming sites offer free public rooms, where the audience can tip the performer, and paid private rooms, some charge per minute for both types and not just the latter and some offer all types (Sanders *et al.*, 2018; Velthuis and Van Doorn, 2020). The act of receiving a tip is typically associated with the viewer directing the content of the stream. This may entail requesting a specific sexual performance or controlling the use of interactive sex toys.

Revenue generation

Some platforms employ a business model that is centered on public shows and tips, which are sometimes referred to as “freemium” or “token” sites; others, which are sometimes referred to as “premium” or “private” sites, prioritize private shows and utilize the public show as a platform for advertising (Sanders *et al.*, 2018; Velthuis and Van Doorn, 2020). Examples of freemium sites include Stripchat, Chaturbate and xHamsterLive, whereas premium sites include LiveJasmin and Streamate (Jokubauskaitė *et al.*, 2023).

Payments on the sites are typically made in the form of a platform-specific currency, often referred to as tokens, which users can purchase. In many cases, the platforms remunerate the creator with a fixed sum of money for each token acquired; as the price of the tokens is contingent upon the quantity purchased due to a bulk discount, it is challenging to ascertain the precise percentage retained by the site (Sanders *et al.*, 2018). With regard to the website Stripchat, the remuneration paid to the models ranges from 48% to 63% (Stripchat, c). This share typically ranges from 25 to 60 percent, which is less than that of other, non-pornographic live-streaming platforms (Franco and Webber, 2024). Some webcam performers operate as independent contractors, while others collaborate with a studio that oversees the technical aspects, advertising, and web traffic, in exchange for a portion of the revenue, which may range from 30% to 50% (Raustiala and Sprigman, 2019; Patella-Rey, 2021).

The magnitude of the tips may vary considerably, from a few cents to several hundred euros. Moreover, as an example, the cost of a private show with a single viewer on Stripchat ranges from approximately 0.7€ to around 30€ per minute (Stripchat, 2024b). Additional services are available on certain platforms. These include private communication with the creator, fixed-fee shows, recorded streams and joining a fan club (Stripchat, b).

The revenue generated by webcamming sites is derived primarily from the percentage retained from the purchase of tokens, with a secondary source of income being advertising revenue (Velthuis and Van Doorn, 2020). Furthermore, they might collect and sell user data, similar to many other websites (Velthuis and Van Doorn, 2020).

2.3 Premium pay sites

Despite a decline in their significance over time, premium pay sites have not become obsolete and continue to retain some relevance. Some of these websites, such as PornhubPremium or XVideosRED, are closely associated with the tube sites, while others operate with a greater degree of autonomy.

Mode of operation

The design of pay sites appears to exhibit a greater degree of diversity than that observed in the design of tube or webcamming sites. While some pay sites adopt a design similar to that of tube sites, others employ a more sophisticated design, bearing resemblance to the design of conventional streaming sites. Furthermore, there is no uniformity in the provision of video comments, with some platforms offering this functionality and others not. However, in general, all pay sites provide the functionality for users to filter the videos displayed according to their preferences.

In contrast to the free nature of tube sites, pay sites are based on a variety of payment models, including subscription, rental, purchase and pay-per-minute access. Given the proliferation of free pornography consumption opportunities and the existence of free pirated premium videos, it is imperative for premium sites to offer more than mere content. In comparison to tube sites, premium sites demonstrate superior reliability, comfort and streaming quality, more carefully curated content, the absence of advertising and/or the ability to better serve users' preferences through a narrower categorisation of content (Darling, 2013; Raustiala and Sprigman, 2019; Le and Penin, 2017).

There are at least three distinct categories of pay sites, classified according to the type of content they offer: studio sites, aggregator sites, and sites that permit user-generated content. The studio sites are operated by a pornographic film studio and predominantly feature their own content. In contrast, aggregator sites aggregate content created by various studios, and in some cases, act as a studio themselves, producing a limited amount of original content for the site. In contrast, the third category features content uploaded

by non-studio users, in addition to licensed content from studios.

Revenue generation

Incentives for both non-studio and studio users to upload content include receiving a fee per view, the amount of which may be contingent upon factors such as the number of views, the acquisition of new subscribers and engagement with the content. Furthermore, users may receive a portion of the subscription fee when acquiring new users, receive tips, sell videos, establish a paid fan club, and utilise the platform as a channel for advertising supplementary sources of income (XVideos, b; Faphouse, a; Stacy, 2024). The mean revenue per 1,000 views appears to be higher on premium sites than on tube sites, which is an expected outcome given that fewer individuals view videos that require a subscription and the economic attractiveness of uploading to premium sites must still be given (Graham, 2022).

The provider of the premium sites evidently generate revenue through charging for subscriptions, per-minute views, video rentals and purchases, as well as a share of any purchases made on their site. To illustrate, the cost of a monthly subscription to two premium sites that allow user-generated content, Faphouse and PornhubPremium, the aggregator site Vrporn and the studio site Brazzers is 11.99€, \$14.99, \$20.10 and 27.91€, respectively (Pornhub, h; Faphouse, b; VRPorn; Brazzers). The premium site DigitalPlayground offers users the option to access its content on a pay-per-minute, rental, or purchase basis, with pricing structures ranging from \$0.10 to \$0.30 per minute, \$6 to \$9 per video, and \$10 to \$20 per video, respectively (DigitalPlayground, 2024). Furthermore, additional revenue can be generated through the display of advertising and the collection of user data.

2.4 Interactive social sites

The popularity of interactive social sites, with the most prominent example being OnlyFans, has grown considerably over recent years (Vallina *et al.*, 2023a). These sites facilitate more in-depth communication with content creators akin to webcamming sites through various types of interactions. Despite not having been designed as an adult platform, OnlyFans rapidly acquired a significant following among adult content creators, such that this type of content now constitutes the majority (Vallina *et al.*, 2023a; Van der Nagel, 2021).

The functionality of OnlyFans is comparable to that of a conventional social media site such as Instagram. Creators set up their profile, which includes a profile picture, a description, and other optional information. Users can subscribe to creators' profiles to access their posts, which may include videos, photos and text. The platform also allows users to like and comment on posts. In contrast to Instagram, approximately 80% of the profiles on this platform are paid for, and content can only be accessed after paying a monthly subscription fee (Vallina *et al.*, 2023a). The permitted range for this fee is between

\$4.99 and \$50 per month (OnlyFans, c). Additional cost-based services include the sale of paid private messages (priced between \$3 and \$100) and paid posts (priced up to \$50), the streaming of paid livestreams, the receipt of tips (priced up to \$200), and the linking of Amazon Wishlists for users to purchase gifts for content creators (OnlyFans, a; Vallina *et al.*, 2023a). 80% of revenue generated on OnlyFans is retained by the content creators, with the remaining 20% distributed to OnlyFans (OnlyFans, b).

2.5 Custom videos and pornographic games

In addition to the previously outlined business models, there are also websites which offer the possibility of purchasing or selling custom pornographic videos. Customers are able to specify a number of characteristics of the video, including the performer, the video format and the storyline. For example, in the custom section of *iwantclips*, prices range from \$2 to over \$100 per minute, with additional costs for higher quality, faster delivery or special requests regarding the content (*iWantCustomClips*).

Furthermore, another form of online pornography is represented by pornographic games on websites such as *Nutaka*. These games allow players to create a digital representation of a sexual encounter through their individual choices. As this interaction involves a single individual interacting with a product designed for sexual stimulation without the intervention of another person, these games can be described as pornographic (Ashton *et al.*, 2019). Some of the games can be accessed without charge, whereas others require users to make a purchase. Furthermore, specific features and additional content within the games can only be accessed through a payment.

3 Market overview

3.1 Market dynamics

Importance of data

Similar to other markets, a significant element influencing the market dynamics of the pornographic ecosystem is the growing significance of consumer data (Raustiala and Sprigman, 2019; Alilunas, 2021). Firstly, collection of data enables companies to tailor their recommendations and website design more closely to consumer preferences, which is likely to increase profits through higher consumer satisfaction and retention (MacDonald, 2019). Secondly, it enables websites to more effectively target their advertising to consumers' preferences and consumption patterns, potentially increasing their revenues by making their advertising space more attractive and by increasing conversion rates for their other websites (Rodeschini, 2021; Alilunas, 2021). In the third instance, the gathered data can be employed not only to target existing content with greater precision but, if a production studio is also under the same ownership, to adapt produced content more closely to consumer demand. This is known as data-driven creativity, which serves to re-

duce the risk of failure inherent to content (Raustiala and Sprigman, 2019; Alilunas, 2021).

Economies of scale

In addition to the advantage of being able to collect and utilise a greater quantity of data, there are other economies of scale at play for larger companies that exert an influence on market dynamics. These include lower computing and storage costs, which are beneficial for the customisation of content and the targeting of advertisements; faster loading times for their websites, which increase traffic and even improve their Google ranking; and the capacity to invest in the analysis of the optimal website design and then apply the results to all their websites, which increases traffic to all of them (Hindman, 2018). This phenomenon is also reflected in websites of the same owner utilising the same content delivery network (Tyson *et al.*, 2016).

Business opportunities for larger firms

Furthermore, the ownership of multiple websites allows companies to engage in loss leader strategies, as not all of their websites are required to generate significant profits independently (Darling, 2013). Moreover, they are able to establish an interconnected system through the utilisation of links between their respective websites, which can serve to restrict the sequential flow of users away from alternative products which is helpful for employing the loss leader strategy (Wu *et al.*, 2021). This is also advantageous for the implementation of the aforementioned loss leader strategies. Furthermore, the ownership of multiple companies of varying types results in a reduced reliance on external parties, such as those who may at some point seek to impose sanctions on adult entertainment companies or those who may be pressured to do so by external parties. To illustrate, in the event that one is the proprietor of an advertising network that places advertisements on its website, less pressure can be exerted on the firm in this domain. This is because all advertisers must cease publishing on the website in question, rather than solely the advertising networks that could be subject to greater pressure.

Vertical and horizontal integration

It can be concluded that the pornographic ecosystem exhibits considerable economies of scale and scope, including data-driven network effects. These factors contribute to the profitability of both horizontal and vertical integration and are likely to create barriers to entry for competitors (Raustiala and Sprigman, 2019; Stucke and Grunes, 2016). Indeed, since at least 2011, a transformation in the structure of the pornographic market, namely vertical integration and consolidation, has been observed (Darling, 2013). This trend has not been reversed in recent years either (Raustiala and Sprigman, 2019; MacDonald, 2019). These circumstances of the pornographic ecosystem are aligned with the description provided by Srnicek (2017) of the consequences of platforms based on data extraction and the generation of network effects: “expansion of extraction, positioning as a gatekeeper, convergence of markets, and enclosure of ecosystems.” The concentration

of power in the hands of a few dominant players is regarded as detrimental to the independent creators of content, as their support and consideration are less important to the dominant players (Sanders *et al.*, 2023). Furthermore, the diminished competition may also result in unfavourable outcomes for consumers.

3.2 Relevant companies

The two most significant entities within the pornographic ecosystem are Aylo, previously known as MindGeek, which owns, for example, Pornhub, and WGCZ Holding, which owns, for example, XVideos (MacDonald, 2019). It is reported that Aylo owns at least 150 websites, while WGCZ Holdings is said to own at least 60 companies (McVey *et al.*, 2022; Kristof, 2021). The holdings of both companies encompass websites based on a variety of business models. These characteristics substantiate the aforementioned market dynamics. Nevertheless, the complete ownership structures of pornographic websites and the relationships between them are frequently opaque, although some insights can be gleaned.

Aylo

The Canadian company Aylo, established in 2004, states on its website that it owns a number of prominent online pornography websites, including tube sites such as Pornhub and YouPorn, premium sites such as Brazzers or DigitalPlayground, pornographic film studios, marketplaces for custom pornographic videos, an advertising network and an affiliate marketing site (Aylo, a). However, as previously stated, its holdings extend beyond the 17 brands listed on the company website. For example, the company's portfolio also includes a billing company (McKee and Lumby, 2022).

WGCZ Holding

WGCZ Holding is a Czech company that was established in 2014; however, the connection between the sole shareholder of WGCZ Holding and the pornographic websites associated with it can be traced back to at least 2003 (spravedlnosti České republiky, c; Meineck and Köver, 2022). As previously stated, their reach also extends to a multitude of pornographic websites, including the most prominent site, the tube site XVideos. Investigations based on the Czech Trade Register have revealed that numerous other companies in the pornographic sector are linked to WGCZ Holding through a common majority shareholding (Meineck and Köver, 2022). These companies operate a number of websites, including the tube site XNXX (NKL Associates s.r.o.), premium sites such as Pornbox (GTFLIX TV), an advertising network (Traffic F, s.r.o.) and an affiliate marketing site (DDF Communication s.r.o.) (Meineck and Köver, 2022; Pornbox; Sexcash).

Technius Ltd/Hammy Media Ltd

Another important actor is the network of through majority shares interconnected Cyprian companies, which includes the operator of the remaining adult VLOP Stripchat, Tech-

nus Ltd. This firm also operates the webcamming website xHamsterLive and the affiliate marketing site Stripcash (xHamsterLive, 2024b; Stripcash, 2024). Investigations have evidenced that these connections extend to numerous other companies operating within the pornographic industry, including the premium site Faphouse (Tecom Ltd) and an advertising network (Traffic Stars Ltd) (Meineck, 2021). Furthermore, relations are established through interlinked work with the company Hammy Media Ltd, which operates xHamster (Meineck, 2021). It is postulated that Hammy Media Ltd represents a facade for a more opaque company structure (Meineck, 2021). xHamster has been operational since 2007, thus also demonstrating a substantial history of experience (Meineck, 2021).

3.3 Relevant websites

3.3.1 Pornhub

Design

Pornhub adheres to the conventional design of a tube site, with the landing page displaying recommended content in the form of numerous rows and columns of thumbnails and titles of pornographic videos. Upon selecting a video, users are presented with the option to comment on the selected video. Moreover, the platform incorporates a search bar for keyword searches and offers a variety of supplementary search tools, including the ability to filter results according to category or performer. Additional sections of the website include a section titled “Community”, which features recent posts and video uploads by other users, as well as a section dedicated to photos and GIFs.

Additionally, the website features a section that, when selected, redirects the user to the LiveHDCams webcamming platform. Moreover, a top bar enables users to be redirected to other pages on the website or additional external websites. In terms of the website’s own content, there are links to the “Sexual Wellness Center”, which offers information resources on matters pertaining to sex and sexuality; the “Pornhub Insights” section, which provides articles and statistics on topics such as user behavior during special events; and the “Trust & Safety Center”, which provides information on the measures taken to enhance the trustworthiness and security of the website. This can be viewed as part of Pornhub’s marketing strategy, which is designed to reduce the negative associations that are linked to pornography and the company’s website. In terms of other sites, Pornhub links to the premium site Spicevids, the site MyDirtyHobby, which enables creators to generate revenue by selling videos and images, chatting or webcamming with users, the tube sites YouPorn, RedTube, Tube8, and its merchandise shop, which primarily sells clothing. All of the above websites are operated by Aylo. This demonstrates the utilisation of their prominent tube site as a promotional platform for their additional services. Furthermore, it deserves mention that Pornhub also permits the auto-export of uploaded videos to the linked sites, YouPorn, RedTube and Tube8 (Pornhub, g).

Data

In terms of website tracking data on visits for February, July and October 2024 from the search engine optimisation company Semrush (Semrush, 2024), Pornhub is the pornographic website with the highest number of visits globally and also in all 27 EU countries, with a consistently significant margin. A different data source for Germany, based on several inputs including different sets of tracking data and representative user panel data, indicates that Pornhub is the second most visited pornographic website during the period from April 2023 to June 2024 (WIK).

Furthermore, the number of unique visitors represents a significant area of interest. According to the same Germany-specific data as above, Pornhub has the second highest number of unique monthly users in 2024 and the third highest in 2023. In 2023, the number of users was estimated to be approximately 10.7 million, declining to around 9.6 million in 2024. This figure is for web users only and does not include app users. As Pornhub does not advertise an app, it seems reasonable to conclude that these estimates cover all users. These estimates are notably higher than the figure of 4.99 million average monthly active recipients (AMARs) (02/2024-07/2024) that Pornhub has stated for Germany (Pornhub, 2024a).

By multiplying the ratio of unique users in Germany in February 2024 to the visits in Germany in the same month measured by Semrush with the EU visits estimated by Semrush for that month, an estimated 113 million monthly users in the EU can be calculated for February 2024. In July and October 2024, there was a notable decline in EU-wide visits to Pornhub compared to February. Based on these figures, the estimated number of users is approximately 60 million. Accounting for the observed variability in the ratio of users per visit, the resulting ranges are 99 to 149 and 52 to 79 million monthly users, respectively. However, according to Pornhub's DSA transparency report there were 28 million AMARs (02/2024-07/2024) in the EU, a figure that is notably lower than any of the previously estimated values. This may indicate that the reported figure is too low, which would be consistent with the European Commission's decision to designate Pornhub as a VLOP.

A further area of interest is the estimated revenue. It is estimated that Pornhub has generated an average of 13 million € in yearly revenue through advertisements over the period 2020 to 2023, with a slight upward trend from 12.3 million € in 2020 to 14.5 million € in 2023 (WIK). In 2023, this equates to an average monthly revenue of 0.11 € per user. These estimates are, however, somewhat less reliable than those pertaining to users and visits.

3.3.2 XVideos

Design

The design of the XVideos website is comparable to that of Pornhub, with similarities observed in the organization of the landing page, the functionality of the search and filter

tools and the commenting functionality. Furthermore, users with an account on XVideos can also download the videos.

XVideos links to a number of additional websites, including the premium pay site XVideosRED, operated by Webprocessing s.r.o. (XVideosRed), the webcamming website XVideosCams, controlled by HC Media s.r.o. for users in the EU (XVideosCams), an XVideos section on the pornographic gaming site Nutaka, operated by Aylo, and XDating, which offers paid memberships for what appears to be a social networking platform with dating elements in a highly explicit manner. Consequently, XVideos is also leveraging its popularity to generate additional revenue through other avenues. Furthermore, it is worth mentioning that XVideos provides the option of auto-exports to XNXX (XVideos, 2024).

Data

The tracking data from Semrush for the months of February, July and October 2024 indicates that XVideos is the second most visited pornographic website worldwide, and also when the user numbers of the 20 most visited sites per EU country are added across EU countries at all three time points considered (Semrush, 2024). In this case as well, the difference to the next most visited player is large. In the individual EU countries, the ranking is between second and fourth place, with the majority of countries having a ranking of second place. The data source for Germany indicates that XVideos was the third most visited pornographic website in that country between April 2023 and June 2024, when the average is considered (WIK). This is consistent with the previous ranking for Germany.

In terms of estimated monthly user numbers in Germany, XVideos is outperformed by at least four other websites in 2023 and by at least six in 2024 (WIK). The number of users was estimated to be approximately 6.8 million in 2023 and 5.5 million in 2024. The XVideos website references an app that may contribute to a slight overall increase in actual user numbers. However, the app is not prominently promoted, and its website is also accessible via a browser on the phone. In addition, a user of the app may also access the website at least once a month, thus already being classified as a web user. Therefore, this does not appear to have a notable impact. The XVideo DSA transparency report, which covers the period from February to May 2024, indicates that there were 5.5 million AMARs in Germany. This is consistent with the estimated data.

The same extrapolation approach as previously outlined yields an estimated 99 million users in the EU in February 2024, with a range of 93 to 110 million. The Semrush ranking indicates that XVideos was also considerably less visited in July and October 2024 than in February 2024. These figures would yield an estimated 54 million users, with a range of 51 to 60 million. As of 17th August 2024, XVideos is stating to have 84 million AMARs (XVideos, c), which is inbetween the two previous estimates for the EU.

The mean yearly advertising revenue of XVideos in Germany over the period 2020 to 2023 has been estimated at 10 million €, a figure that is slightly lower than that of Pornhub (WIK). While both companies exhibited a comparable level of revenue in 2020, XVideo's

estimated revenue has exhibited a gradual decline, reaching 8.9 million € in 2023. This equates to an average monthly revenue of also 0.11 € per user in 2023.

3.3.3 XNXX

Design

XNXX also adheres to the conventional design of a tube site, albeit with a slight deviation. The landing page displays thumbnails of videos categorised into distinct groups, with the actual videos presented in a grid only after the user has clicked on a thumbnail. Furthermore, the search, filtering and commenting features are also characteristic of tube websites. Furthermore, it provides the option of downloading. The website contains a section dedicated to images and a forum for user interaction.

Furthermore, the website comprises multiple sections that, upon selection, redirect the user to the webcamming site XNXXCams, controlled by HC Media s.r.o. for users in the EU (XNXXCams), to a website with sexual stories, to an XNXX section on the pornographic gaming site Nutaka, to XDating and to the premium site XNXXGOLD, which is operated by Bridgemaze Partners s.r.o., owned by the same person as the operator of XVideosRED (XNXXGold; spravedlnosti České republiky, a,b). XNXX employs a comparable promotional strategy to that of preceding tube sites, with a notable commonality with XVideos.

Data

In the Semrush ranking, XNXX is identified as the third most visited pornographic website globally across all three months, and in February and July, it is also the third most visited website in the EU (Semrush, 2024). In October, XNXX ranked fourth with respect to the EU level. In terms of the individual EU countries, the ranking falls between second and seventh place. The second dataset for Germany shows that XNXX was the fourth most visited pornographic website in Germany over the time period April 2023 to June 2024, which is consistent with the previous ranking (WIK).

In terms of user data, XNXX is estimated to rank no higher than seventh in 2023, with 5.6 million monthly users, and no higher than sixth in 2024, with 6.3 million monthly users. XNXX does not appear to mention any app on its website such that these estimates encompass all users.

The same extrapolation approach as previously outlined yields an estimated 68 million users in the EU in February 2024, with a range of 60 to 82 million. As with the other two tube sites, XNXX was visited less frequently in July and October than in February. This data leads to an estimated user base of approximately 39 million, with a range of 35 to 47 million. According to its reporting, XNXX was having 77 million AMARs as of 17th of August 2024 (XNXX, a). This figure is higher than the two estimated values, but is consistent with the observed fluctuations.

The estimated average advertising revenue of XNXX in Germany for the period between 2020 and 2023 has been calculated to be 7 million €. Consequently, the figure is markedly lower than those from the aforementioned websites. However, XNXX has experienced a gradual increase in yearly revenue, rising from 5.7 million € in 2020 to 8.3 million € in 2023. This growth has resulted in a revenue level comparable to that of XVideos in 2023. This equates to an average monthly revenue of 0.12 € per user in 2023, which is comparable to the preceding two websites.

3.3.4 xHamster

Design

The landing page and search, filtering and commenting functionality of xHamster are also designed in the conventional manner for a tube site. The only exception to this is that content from the premium site Faphouse, and on occasion the webcamming site xHamster-Live, is also displayed on the landing page, in addition to xHamster's own content. There is a section related to photos on the website and another related to "Dating", though the concrete use case remains unclear.

The sections that redirect the user upon selection direct the user to the webcamming site xHamsterlive, the premium site Faphouse and, under the tab "Sex Chat" the site Flirtify, which is operated by AmuzelT Ltd.

Data

In the Semrush rankings, xHamster is identified as the fourth most visited pornographic website globally in all three months and also across the EU in February and July and the third most visited pornographic website in the EU in October. In the individual EU countries, the ranking is between second and seventh place. In the second data set for Germany, xHamster is the most visited pornographic website in Germany for all months from April 2023 to June 2024, one position higher than in the previous Semrush ranking for Germany (WIK).

In accordance with the most visits, xHamster is also exhibiting the highest number of monthly users in Germany in both 2023 and 2024, with approximately 25.8 million monthly users in 2023 and 30.7 million in 2024 (WIK). xHamster mentions an app on its website, which is, however, a web-app. Therefore, the estimates for the web user also encompass those of the web-app.

The same extrapolation approach as previously outlined leads to an estimated 213 million monthly users in the EU in February 2024, with a range of 162 to 262 million. The number of visits to xHamster was also less numerous in July and October 2024 than in February. For these months, the approach leads to around 133 million users and a range from 101 to 164 million. xHamster has reported a total of 29.03 million AMARs in the EU as of 15 August 2024, a figure that is considerably lower than any of the previous

estimates (xHamster, a). It thus appears that the estimated and reported figures are not easily reconcilable in this instance.

It has been estimated that the annual advertising revenues of xHamster in Germany over the period between 2020 and 2023 amounted to €22 million, representing the highest level of revenue generated by the tube sites in question (WIK). Its revenue commenced at the highest level of all tube sites, with 19.0 million € in 2020, and even exhibited a notable increase to 25.0 million € in 2023. This equates to an average monthly revenue of 0.08 € per user in 2023, which is slightly lower than the estimated figures for the other tube sites.

3.3.5 OnlyFans

As OnlyFans is only accessible to users with an account, a detailed description of the design will not be presented here. However, the general functionalities have already been described in Section 2.4.

Data

The most relevant interactive site with regard to visits is that of OnlyFans. In the Semrush ranking, OnlyFans is positioned in fifth place globally across all three months, and is also the pornographic website with the fifth highest number of visits in the EU across all three months. There is a notable discrepancy in the number of visits to the previous websites, which highlights the significant traffic that the four aforementioned tube sites receive. The geographical spread of OnlyFans across the EU is more extensive than that of the preceding tube sites. The highest score in a single EU country is also the fifth place, although in some cases it is not among the 20 most visited websites.² According to the second dataset for Germany, more pornographic websites surpass OnlyFans in terms of visits, including some webcamming sites such that it is the ninth most visited website at most (WIK).

The ranking of the number of monthly users in Germany is aligned with that of visits to the website. In both 2023 and 2024, the estimated average monthly number of users in Germany was approximately 2.7 million (WIK). OnlyFans does not have an app such that the user numbers represent the total number of users.

The same extrapolation approach as previously outlined results in an estimated 22 million users in the EU in February 2024, with a range of 21 to 25 million. OnlyFans was also less visited in July and October. The adjusted number of monthly users is approximately 13 million, with a range of 12 to 15 million. However, as OnlyFans is not among the 20 most visited websites in the adult industry in all countries, the total number of visits may be slightly higher when the top 20 is extended to include all visits. It has only been reported by OnlyFans that the number of users is below the 45 million threshold as of 1 July 2024 (OnlyFans, 2024d).

²It should be noted that the Semrush ranking includes sites such as escort directories, which are not relevant in this context. Therefore, the rankings should be considered as a minimum estimate.

Despite the fact that OnlyFans is considerably less visited than the preceding tube sites, its estimated average yearly revenue in Germany is 35 million €, which is a considerably higher figure than that of the tube sites WIK. This is based on a business model that does not rely on free advertising, but on revenue generated from user purchases. Furthermore, the estimated revenue generated by OnlyFans has exhibited a considerable growth, increasing from 11.7 million € in 2020 to 53.4 million € in 2023. This equates to an average monthly revenue of 1.61 € per user in 2023, which is significantly higher than that observed on tube sites.

As a UK private limited company, Fenix International Ltd., the firm operating OnlyFans, offers a more detailed insight than other firms. The data reveals that the global revenue generated by OnlyFans in 2023 was equivalent to US\$6.6 billion (Companies House, & Statista, 2024). This indicates that approximately 0.8% of the company's revenues have been generated in Germany.

3.3.6 Webcamming websites

Design

The website design of the analysed webcamming sites is also similar to that of the tube sites, with a plethora of thumbnails of streams organised in rows and columns, as well as search and various filtering functions being available. A notable difference between this format and those of the tube sites is the absence of links to external websites within the design. It should be noted that two of the more popular webcamming sites, xHamsterLive and Stripchat, employ a strikingly similar design. Furthermore, the web streams that they advertise have a considerable degree of overlap, whereby the streams of the creators, their comments and interactions are displayed on both sites at the same time and can therefore be accessed on both sites.

Data

In February 2024, no webcamming website was among the 20 most visited adult sites worldwide in the Semrush ranking. By July 2024, xHamsterLive had ranked 8th and even 6th when the focus was narrowed to sites with a pornographic focus. By October 2024, these ranks had been 10th and 9th, respectively. In the context of the EU, xHamsterLive was the most visited webcam platform in all three months. In February, the ranking was 16th; however, with a more narrow focus on pornographic websites, the ranking was 11th. In July and October, the respective rankings were 7th and 6th. The highest ranking achieved in an individual EU country is seventh place. The distribution of significance among the individual EU countries is more extensive than that observed in the previous sites. However, the second dataset for Germany does not indicate that xHamsterLive is the most visited webcamming website. Rather, it is consistently surpassed by at least two of three other webcamming sites, namely Chaturbate, Stripchat and LiveJasmin (WIK).

In terms of estimated monthly users, Stripchat had 11.9 million in Germany in 2023, LiveJasmin 9.67 million, Chaturbate 6.32 million and xHamsterLive 4.19 million. In 2024, the respective figures were 8.92 for Stripchat, 9.06 for LiveJasmin, 6.49 for Chaturbate and 4.19 for xHamsterLive. Hence, there was a notable decline in users on Stripchat. Stripchat mentions an app on its website, which is web-app such that the estimates for the web users encompass these of the web-app; the other webcamming websites do not mention any app. The figures for Stripchat are notably higher than the 3.2 million AMARs reported by Stripchat for the period between December 2023 and May 2024 in Germany (Stripchat, 2024a).

The extrapolation approach employed yields an estimated 9 million monthly users of xHamsterLive in the EU in February 2024, with a range of 9 to 10 million. The number of visits to xHamsterLive in July and October was higher than in other months, resulting in an adjusted figure of around 13 million users, with a range of 12 to 13 million. Nevertheless, as with OnlyFans, the website is not consistently among the top 20 regarded websites in all individual EU countries. Consequently, this indicates a somewhat lower bound. As the other webcamming websites are rarely or never represented among the top 20 in the Semrush ranking, this approach is not an effective strategy for them. However, an alternative, more abstract approach, which postulates that the EU-wide numbers for Stripchat, Chaturbate and LiveJasmin are underestimated in the Semrush ranking, as indicated by the German-only numbers, may prove a fruitful strategy. It is assumed that the ratio of visits to these sites and xHamsterLive in February 2024, as observed in the Germany-only data, is also applicable to the EU numbers. Furthermore, it is assumed that the ratio of users per visit is equal across the webcamming sites. This results in estimated figures of approximately 17, 12, and 10 million monthly users for Chaturbate, LiveJasmin, and Stripchat, respectively, in February 2024. For these websites, this also indicates a somewhat lower threshold.

In regard to the reported AMAR numbers of xHamsterLive in the EU, as of the 1st of August 2024, 6.8 million are reported for the domain xhamsterlive.com (on which the previous estimation of users is based) and 26.6 million for xham.live (xHamsterLive, a,b). The two sides display comparable layouts and content, which is largely equal. Therefore, xHamsterLive does not present a unified figure encompassing the entirety of its domain holdings, thereby giving rise to the question of how these figures should be aggregated in order to arrive at a total user count. Furthermore, as previously stated, Stripchat also exhibits a high degree of similarity in its streaming content. Moreover, upon attempting to become a model on xHamsterLive, the user is redirected to Stripchat. Stripchat reported the same number of AMARs as xham.live (Stripchat, a). In addition, it is noteworthy that, on occasion, content from xHamsterLive was embedded as advertisements on the xHamster landing page, thereby possibly increasing the true number of AMARs. Consequently, the alignment of the estimates and the reported numbers is challenging, already due to the opaque service structure. LiveJasmin reported to have 13.2 million AMARs as of 30th

of June 2024, which is similar to the estimated value (LiveJasmin). No data on the number of AMARs was identified for Chaturbate.

In terms of estimated revenue for Germany, approximately 70% of the revenue generated by webcamming sites is derived from user payments, with the remaining 30% derived from advertising (WIK). Chaturbate had the highest average yearly revenue in Germany between 2020 and 2023, at 40 million €. This was followed by Stripchat with 34 million €, LiveJasmin with 17 million €, and xHamsterLive with 15 million €. It is worthy to note that LiveJasmin's revenue has risen significantly, from 9.07 million € in 2020 to 23.36 million € in 2023. Similarly, xHamsterLive has experienced a notable increase in its overall revenue, from 9.49 million € in 2020 to 17.96 million € in 2023, with this growth occurring predominantly until 2022. Therefore, in terms of absolute values, the webcamming websites display a higher revenue than the majority of tube sites, and most of them generate less revenue than OnlyFans. This is based on the higher average monthly revenue per user on webcamming sites (0.2 € to 0.46 €) in comparison to tube sites.

These figures highlight the significance of the four tube websites, xHamster, Pornhub, XVideos and XNXX, among the populations of the EU member states. It is also evident that a number of webcamming websites and OnlyFans play a significant role particularly in regard to revenue generation. Premium websites are not as frequently visited and therefore not represented (Raustiala and Sprigman, 2019).

4 User base

Prevalence

While a substantial body of research has been dedicated to the prevalence of pornography in general, studies focusing on internet pornography are relatively scarce. Furthermore, a considerable number of studies concentrate on particular demographic groups, such as adolescents or males exclusively, and employ a more expansive definition of pornography. Tracking panels present the advantage of mitigating the impact of social desirability bias and recall bias, compared to surveys, when investigating individuals' pornography consumption. Additionally, participants in a survey may possess divergent interpretations of what constitutes pornography (Lewczuk *et al.*, 2022; von Andrian-Werburg *et al.*, 2023).

von Andrian-Werburg *et al.* (2023) note that 46% of participants in a non-representative web tracking panel in Germany had used online pornography on dedicated websites within the time span of one year across 2018 and 2019. 25% of participants in a similar study in Poland with a representative panel have used it during one month in 2016 (Lewczuk *et al.*, 2022). It should be noted that in both studies, it was possible to pause the tracking either manually or by using a private browser. Furthermore, as Lewczuk (2022) discovered, the proportion of pornography users has been rising from 8% in 2004 to 25% in 2016. Consequently, the precise scope of current usages remains ambiguous, yet their pervasiveness is evident, as already indicated by the figures presented in the preceding

chapter. In particular, given that the data were collected several years ago and an increase over time has been documented.

User characteristics

The consumption of internet pornography has been observed across a diverse user base, with varying levels of engagement observed across different age groups, genders, cultural backgrounds and other sociodemographic factors. A number of studies have indicated that the proportion of males who have already been exposed to pornography or who use it is considerably higher than that of females. Exact numbers range from 96% to 99% of men and 79% to 92% of women ever coming in contact with pornography, estimates regarding consumption within a year of 66% to 92% for men and 26% to 68% for women as well as monthly estimates of 47% to 92% for men and 27% to 60% for women (Solano *et al.*, 2020; Lewczuk *et al.*, 2022; von Andrian-Werburg *et al.*, 2023; Eljawad *et al.*, 2021; Price *et al.*, 2016; Martyniuk and Dekker, 2018). The evidence suggests that gender differences persist across various age groups. Nonetheless, there is some indication that the discrepancy is less pronounced in younger age groups (Lewczuk *et al.*, 2022; von Andrian-Werburg *et al.*, 2023). Moreover, younger age groups are more likely to have used pornography than older age groups (Price *et al.*, 2016; Lewczuk *et al.*, 2022; von Andrian-Werburg *et al.*, 2023).

With regard to the frequency of internet pornography consumption, a gender disparity is also evident, with males consuming pornography more frequently than females (Martyniuk and Dekker, 2018; von Andrian-Werburg *et al.*, 2023; Eljawad *et al.*, 2021). Using a linear regression model, von Andrian-Werburg *et al.* (2023) ascertain that males engage in approximately seven times more pornographic web sessions per month than females. The study found that the frequency of internet pornography consumption remained consistent across age groups within the same gender, when controlling for other variables. However, other research found that pornographic usage frequency declines with age (Martyniuk and Dekker, 2018).

Characteristics of use

Firstly, focusing on the frequency of pornographic usage, von Andrian-Werburg *et al.* (2023) found that the average number of sessions per month was 6.4 in their sample. Nevertheless, given the relatively substantial standard deviation (11.64), it appears that outliers may be exerting an upward bias on the result. In line with this result, Morichetta *et al.* (2021) find that approximately 75% of users visit web pornography five days or fewer a month and that they rarely access web pornography multiple times in a day. Similar numbers were also found in a survey (Eljawad *et al.*, 2021). Regarding the time spent watching internet pornography, Morichetta *et al.* (2021) found that the average time spent per week was 37 minutes with each individual session being rather short, with most sessions being under 15 min. Solano *et al.* (2020) finds similar figures in a survey in terms

of time spent per week consuming pornography, with men spending around 68 minutes and women approximately 22 minutes per week.

Focusing on behaviour on the platforms, it was found that video access is highly concentrated on specific videos, with the top 10% of videos making up 73.7% of all video accesses (Grammenos *et al.*, 2020). In accordance with this, they find that the majority of views arrive from the main video page. The search function and the homepage are also used extensively. Furthermore, multiple studies have found that engagement using comments and ratings on pornographic websites is quite limited (Tyson *et al.*, 2016; Wong *et al.*, 2020).

Focusing on the use of specific pornographic websites in Germany, it was found that popular tube websites such as XNXX, Pornhub, xHamster and XVideos are visited longer than less popular tube websites and webcamming websites (WIK). The mean duration of time spent per session on the most popular tube websites ranges between 14 and 26 minutes, with an average of 18 to 25 pages per visit, while the three less popular tube websites are visited for 4 to 10 minutes, with an average of 6 to 11 pages per visit, and webcamming websites for 3 to 10 minutes, with an average of 2 to 13 pages per visit. OnlyFans is positioned at the lower end with an average of five minutes and five pages per visit. Consequently, in addition to being more frequently visited, the usage on popular tube websites appears to be more extensive

5 Societal issues

The categories for which the VLOPs are obliged to conduct a risk assessment provide a good basis for which categories to regard. Category (a) in Article 34 of the DSA relates to illegal content. Category (b) relates to negative effects for the exercise of fundamental rights. Category (c) relates to negative effects on civic discourse and electoral processes, and public security and category (d) to negative effects in relation to gender-based violence, the protection of public health and minors and serious negative consequences to the person's physical and mental well-being. With the exception of category (c), issues pertaining to all categories are evident.

5.1 Illegal content

5.1.1 Background

There are several different types of illegal content that have been associated with pornographic websites, most prominently copyright-infringing material, CSAM and NCSM, including non-consensual synthetic intimate material created for example with deepfake technology.

The E-Commerce Directive establishes that pornographic websites, like other websites, are generally not liable for third-party content unless they have become aware of its problematic nature and have failed to remove it; the DSA also maintains this limited

liability (Sorbán, 2023). Therefore, the existence of illicit material does not inherently constitute a legal problem for the websites. Additionally, the business model employed by tube websites is dependent upon substantial visitor numbers, which are generated through the provision of a comprehensive range of content; this can culminate in an emphasis on quantity over quality, which may, in turn, give rise to the presence of illegal material (MacDonald, 2019). As the majority of views are generated by new videos on the front page and since it can take some time for illegal material to be identified and then removed, and potentially reuploaded by another user, tube websites can effectively deprive illegal material of the majority of its benefits, even if it is eventually identified as such (Darling, 2013). Consequently, a belated response to a copyright request may also be in the website's interest (McKee and Lumby, 2022). Furthermore, the distinction between legal and illegal content is likely to be more subtle on a pornographic website than on others, which may result in reduced offence among viewers and consequently lower incentives for pornographic websites to remove such content (Blegen, 2023).

Premium, webcamming and interactive social sites prioritize convenience, quality, and interactivity, as well as curated and niche content, over the sheer quantity of content (Le and Penin, 2017). Therefore, by business model, the issue of illicit content should be less pronounced than on tube websites, given the presence of more intrinsic incentives for content moderation. However, some of these websites contain illegal material anyway. Given the real-time nature of webcam streaming, it is probable that the illicit material observed on webcamming websites differs from that encountered on video on demand websites.

It is important to acknowledge that in recent times, external pressure has been exerted on the adult industry by the limited number of payment processing services that are active within this sector (Franco and Webber, 2024; Webber and Franco, 2024). It is therefore reasonable to conclude that some of the solutions that are currently in place are, at least in part, a consequence of this. To illustrate, following allegations made at the end of 2020 concerning the existence of illicit content on Pornhub, the company implemented certain modifications to existing policies, including the prohibition of downloads, the limitation of uploaded content to identified users, and the removal of a significant portion of the existing content (Sorbán, 2023; Blegen, 2023; Reuters, 2020; McKee and Lumby, 2022; Valinsky, 2020). However, the guidelines issued by payment processing services are open to interpretation, resulting in differing rules being applied on different platforms (Webber and Franco, 2024). Furthermore, the regulations may place a considerable emphasis on brand image, which could diverge from legislation that is exclusively focused on the health and safety of society and be less transparent (Webber and Franco, 2024; Pollak, 2022). However, the introduction of the DSA in the EU may augment this situation, thereby providing further external incentives for the implementation of optimal solutions.

5.1.2 Copyright-infringing material

Copyright infringement of pornographic material is not solely a matter pertaining to category (a) of Article 34 of the DSA; it also falls under category (b) due to contravention of Article 17 of the Charter of Fundamental Rights of the European Union, which protects the right to property. The issue of copyright infringement is a pervasive phenomenon in the context of pornographic online content, particularly on tube websites (Darling, 2013; MacDonald, 2019; Patella-Rey, 2021). Indeed, it has been postulated that the rise of more interactive business models and experience goods, which are less susceptible to piracy, such as webcamming, has been driven, at least in part, by the issue of copyright infringement (Darling, 2013; Raustiala and Sprigman, 2019; Patella-Rey, 2021). While the piracy of pornographic material is also present on P2P networks, the most significant source of copyright infringement can be attributed to tube websites as, among other things, the convenience of accessing pirated pornography through tube websites is perceived to be higher than when utilising P2P networks (Darling, 2013).

For the individual creators, the act of piracy represents a breach of their consent, given that the consumption of their material was contingent upon conditions such as the prospect of remuneration or limited distribution (Garcia, 2024). Moreover, they suffer direct financial harm, the extent of which may vary depending on whether they are remunerated in proportion to the revenue generated by their pornographic material or according to a one-time fee (Garcia, 2024). Due to their ownership of a multitude of businesses within the pornographic industry, including production studios, premium websites, and tube websites, major corporations have somewhat diminished negative impacts resulting from copyright infringement. This is due to the fact that they are able to generate revenue from both non-infringing and infringing material.

Data

In its voluntary annual transparency report, published since 2020, Pornhub states that approximately 83% of content removed in relation to its terms of service was due to notices of copyright infringement (Pornhub, a). In the years 2021 to 2024 (first half-year), the percentages of content removed or blocked at upload in relation to the terms of service were notably lower, at 4.9%, 6.9%, 1.3%, and 0.5%, respectively (Pornhub, b,c,d,e,f).³ Furthermore, Pornhub also blocked material that had already been identified as infringing copyright during the uploading process. In 2020, the figure was approximately 20% of the volume of removals related to copyright notices subsequent to upload (Pornhub, a). It is noteworthy that the total volume of content removed in 2020 was more than three times that of 2021 and 2022, and more than 1.5 times that of 2023. The elevated number of content removals observed in 2020 may be attributable to Pornhub's revised service guide-

³The majority of removals are related to content uploaded prior to the specified period, and thus do not include content that was blocked at upload. Consequently, when considering only the removed content, without including content that was blocked at upload, as is the case with the 2020 figure, a notable decrease from 2020 to the following years is still evident.

lines, which included the restriction of content uploads to only those created by verified users, following allegations made towards the end of 2020 that resulted in external pressure being applied to the company by payment processing services (McKee and Lumby, 2022). The rise in the amount of content removed in both 2023 and 2024 in comparison to the preceding two years can be attributed to the implementation of a co-performer verification, which accounts for approximately 50% of removals. Consequently, the decline in absolute numbers is less pronounced in these two years than it is in relative terms.

In regard to the DSA transparency reports, Pornhub has stated that approximately 13% of removals in response to user reports have been based on copyright infringement (Pornhub, 2024a). XVideos has reported that between 3.3 and 4.6 percent of the removed content, based on the site's own moderation and notices, was due to copyright infringements (XVideos, d).⁴ Stripchat did not impose any restrictions based on the infringement of intellectual property, and there were few reports from users on this topic (Stripchat, 2024a).

The existing literature demonstrates that copyright infringements are a pervasive problem, particularly on tube websites. This is evidenced by data indicating that popular tube websites also remove a notable proportion of content related to this topic, indicating a minimum prevalence rate. The data also suggests that alterations to the service guidelines may impact the prevalence of pirated material, or what proportion of such material is not removed at upload. The findings thus indicate that websites that have been subjected to less external pressure may display a higher prevalence of pirated content that has not been removed. In general, when considering these figures, it should be borne in mind that the removal rates do not perfectly align with the prevalence of piracy. A modification of the removal strategy may also account for any observed changes without necessitating a change in prevalence.

5.1.3 CSAM

CSAM is not solely associated with the category of illegal content; it is also linked to category (b) due to factors such as the neglect of the rights of the child and to category (d) due to inadequate protection of the child and adverse effects on the child's health. The fear of images of CSAM being distributed and viewed by others, which results in a persistent vulnerability, contributes a distinctive element to the trauma experienced by the child depicted in CSAM (Gewirtz-Meydan *et al.*, 2018). CSAM can be accessed via multiple ways such as searching the indexed content on the surface web, apparently legal adult pornography sites, P2P networks and the Darknet (Hunn *et al.*, 2023). Furthermore, regular pornographic websites and social networks can also be utilized as potential avenues (Hunn *et al.*, 2023). The principal means of distribution and access to CSAM are, however, P2P networks and networks with anonymised access, such as the Darknet (Europol).

⁴The figure has been presented as a span due to the absence of clarity regarding the proportion of removals that have been erroneously categorised as non-consensual material. As indicated in the report, there is evidence that some cases have been incorrectly categorised, but the precise number remains unclear.

The availability of CSAM is primarily an issue of insufficient content moderation in general rather than an inherent difficulty associated with pornographic websites (McKee and Lumby, 2022). But it is also important to acknowledge that the admissibility of pornographic content may potentially complicate the identification process, as it may be easier to identify pornographic material in general than to assess whether the depicted individuals are minors. In 2020, an article in the New York Times alleged Pornhub of disseminating illegal material, including CSAM, employing minimal content moderation and removing only a fraction of such material, even when flagged by users. (Kristof, 2020). As previously stated, Pornhub has responded to this by implementing a series of modifications to its existing policies. This example concerns Pornhub, but the issue is not exclusive to this platform. Similar concerns have been raised about other pornographic platforms, as also noted in this article. This suggests that, at least in the past, a limited commitment to sufficient content moderation was present.

Data

In its annual voluntary transparency reports, Pornhub states that 11.7%, 6.1%, 1.8% and 0.9% of material removed in relation to its terms of service was related to potential CSAM, respectively, across the years 2021, 2022, 2023 and 2024 (first half-year) (Pornhub, b,c,d,e,f). While the absolute values are also declining, this is not as pronounced as the percentage decline, due to a significant increase in the overall volume of material removed in 2023 and 2024.

As outlined in the DSA transparency reports, 2.7% of the actions taken in response to user reports on Pornhub were related to potential CSAM, while 8.6% of the videos and 0.2% of the images removed through internal moderation were related to potential CSAM, leading to an overall figure regarding internal moderation of 1% (Pornhub, 2024a). XVideos reports that 0.96% of the through own moderation and notices removed content falls into the categories of “Pedophilia” and “Underage” (XVideos, d). It is noted that the category “Underage” “contained non-sexual material, cartoons and 3D animations.” Stripchat reports that 0.6% of the restrictions imposed are related to the “Protection of minors”, although the precise scope of this category is not evident (Stripchat, 2024a).

It thus follows that, as is the case for other websites featuring user-generated content, sufficient attention must be paid to CSAM on pornographic websites, particularly given the greater difficulty in recognising it on these sites. Nevertheless, it seems that without external pressure, insufficient content moderation has been employed in the past to address this issue.

5.1.4 NCSM

The non-consensual sharing of private sexual material, including synthetically manipulated material, constitutes a form of image-based sexual abuse (McGlynn and Rackley,

2017). The European Parliament and the Council have classified this as a criminal offence in the directive of 14 May 2024 on combating violence against women and domestic violence. It is required that this directive is incorporated into national law by 14 June 2027 at the latest. It is already the case that a number of EU states have introduced a distinct legal framework for the regulation of NCSM, as is the case in the majority of US states (Mania, 2024). Accordingly, the NCSM is included in the category of illegal content. NCSM is also linked to negative effects on the exercise of fundamental rights such as respect for private and family life or dignity, as well as negative effects in relation to gender-based violence and well-being (McGlynn and Rackley, 2017).

The distribution of NCSM occurs via a multitude of routes, including social media platforms, online forums, pornographic websites, instant messaging applications, and P2P networks (Henry and Flynn, 2019; Huber and Ward, 2024). Social media, mobile phones, and pornographic websites have been identified as significant sources for the dissemination of such material (Huber and Ward, 2024; Short *et al.*, 2017). The aforementioned allegations regarding Pornhub at the end of 2020 also related to the presence and insufficient moderation of NCSM. Given that pornographic content in general is not prohibited on pornographic platforms, the probability of its removal is presumably lower in general, which may provide an incentive for its publication. NCSM is associated with adverse psychological and somatic health outcomes, as well as economic and social damages for the affected person and pervasive effects across numerous aspects of life, with the specific harms depending on the concrete case (Ruvalcaba and Eaton, 2020; Eaton and McGlynn, 2020; McGlynn *et al.*, 2021). It is observed that women are more frequently affected by NCSM than men, while men are more prone to perpetrate NCSM; additionally, emerging adults are more likely to be affected than older age cohorts (Ruvalcaba and Eaton, 2020; Eaton and McGlynn, 2020; McGlynn *et al.*, 2021).

A more recent subcategory of this area is the non-consensual sharing of synthetic intimate imagery, which encompasses the so-called “deepfake pornography”, although the term “pornography” is not considered an adequate description in this context. (Umbach *et al.*, 2024). As a result of technological advancements, the production of such videos has become easier, whereas the process of identifying manipulated videos has become significantly more challenging (Umbach *et al.*, 2024). Research found that approximately 96%-98% of deepfake videos available online are pornographic, with women being the primary subjects in the vast majority of instances (Security Hero, 2023; Ajder *et al.*, 2019).

Data

In its voluntary transparency reports, Pornhub states that 16.6%, 8.5%, 2% and 2% of the content removed in 2021, 2022, 2023 and the first half of 2024, respectively, were removed due to the content being non-consensual (Pornhub, b,c,d,e,f). In the two preceding years, 2021 and 2022, prior to the introduction of co-performer verification, NCSM as the second most frequent reason for removal after the “General Violations of Terms of Service” category, which accounted for 64% and 78% of the removals, respectively (Pornhub, b,c). The

total number of these removals is also declining, albeit at a slower rate than the percentage decline.

In regard to the DSA transparency reports, Pornhub indicates that 12.7% of the removals based on user notices are attributable to non-consensual behaviour, while 1.1% of videos and 0.1% of images removed by internal moderation are likewise based on this reason. (Pornhub, 2024a). XVideos does not clearly state which categories contain NCSM. The aggregate of content removed under the categories “Consent”, “Non-consensual”, “Non-consensual Candid Filming”, “Rape (Real)”, “Revenge Porn”, and “Stolen Private Content” represents 2.3% of the total content removed (XVideos, d). Stripchat did not impose any restrictions based on its own moderation policies regarding non-consensual behaviour. Approximately 2% of user notices pertain to this topic, but the accuracy of this percentage is not stated. (Stripchat, 2024a).

Consequently, the issue of NCSM is also prevalent, especially on tube websites. The real-time nature of webcamming may present certain challenges in the distribution of NCSM, particularly in comparison to pre-recorded material. However, this does not preclude the possibility of NCSM being made available on webcamming sites. In general, this material may be more challenging to identify through internal moderation, as it may appear consensual without being consensually shared.

5.2 Negative effects on the exercise of fundamental rights

5.2.1 Privacy

The Charter of Fundamental Rights of the European Union enshrines the right to the protection of personal data and the private and family life. The revelation of information pertaining to sexual practices is not aligned with the aforementioned protection, and thus falls within category (b) of Article 34 of the DSA. Individuals who access pornographic websites reveal a considerable amount of personal information, including details pertaining to their sexual preferences. In many instances, even the URL of the website can indicate which sexual orientation is catered to on this site (Maris *et al.*, 2020). It is of particular importance to safeguard this information, given that a stigma is associated with certain legal sexual preferences.

Tracking and safety

As with other websites, pornographic websites track the users, with estimates suggesting that approximately 70-80% of them employ third-party cookies, while 5% utilise advanced fingerprinting technologies (Vallina *et al.*, 2023b; Maris *et al.*, 2020). This allows for the monitoring of user interactions with the website, which may potentially facilitate the inference of the user’s sexual orientation. Furthermore, it has been documented that cookie synchronisation occurs between different pornographic websites in 58% of the top 100 most popular pornographic websites. (Vallina *et al.*, 2023b). This practice enables the

sharing of cookie information between services. Moreover, instances on adult websites have been observed in which stateful tracking methods, such as via cookies, have been implemented together with stateless tracking methods, such as the use of fingerprinting, to recreate any cookies after a deletion by the user (Fouad *et al.*, 2021). A significant proportion of the third-party service providers active on pornographic websites are distinct from those active on non-pornographic websites, such as exoClick, JuicyAds or EroAdvertising, but also more widespread third-party domains of Google or Oracle are observed (Vallina *et al.*, 2023b; Maris *et al.*, 2020). Nevertheless, the tracking of users on pornographic websites appears to be primarily conducted by a small number of companies (Maris *et al.*, 2020).

Furthermore, an analysis revealed that only 17% of pornographic websites had an encrypted homepage, which could even potentially allow for the interception of login credentials (Maris *et al.*, 2020). In particular, less popular pornographic websites are less inclined to support HTTPS, with only 22% of such websites offering this option, compared to 92% of the most popular sites; a similar trend is observed for the embedded third-party services (Vallina *et al.*, 2023b). Moreover, studies have demonstrated that a relatively limited number of pornographic websites have implemented privacy policies and a cookie consent form, even when accessed from regions where such policies are legally required (Vallina *et al.*, 2023b; Maris *et al.*, 2020).

Advertising based on sensitive information

In relation to the matter of privacy, the question arises as to whether advertising companies operating within the pornographic sector utilise sensitive data, such as sexual orientation, in targeting advertisements, a practice that is prohibited by the DSA. The business strategy of advertising companies active in the pornographic sector is closely related to the sexual orientation of users, given that the majority of advertisements relate to sexual content. Therefore, the utilisation of data pertaining to sexual orientations, for instance, as collected through cookies, has the potential to yield financial gains, perhaps in the form of increased click-through rates on advertisements. An investigation into the websites of prominent pornographic advertising services that have been observed to utilise cookies reveals a range of targeted marketing strategies, including keyword, group, website and niche targeting (Eroadvertising; Exoclick; JuicyAds). Certain keywords, niches and website names may already be directly associated with specific sexual preferences. Consequently, the question arises as to when targeted advertising based on sexual preferences commences and to what extent such targeting, also based on information collected in cookies, is currently employed.

This finding suggests that sensitive information is being collected on pornographic websites, and that this information may not be adequately protected. The extent to which advertisements are targeted based on sexual orientation remains uncertain.

5.3 Negative impacts on health, safety and well-being

5.3.1 Harmful material

Not illegal yet harmful content relates to risk category (d). While such content, including material related to sexual objectification or gender-based violence, may not inherently violate legal statutes, it can nonetheless perpetuate harmful beliefs, behaviours, and attitudes that pose serious risks to the well-being of individuals and society. The research on causal relationships in this area remains limited and inconclusive, with clear causal evidence of negative consequences still absent. This is therefore an area that warrants further investigation, though current findings do not yet establish definitive harm.

Sexual violence

For instance, the relationship between pornography and sexual violence remains a topic of contentious debate, with no clear consensus on causality. Research highlights significant variability in the prevalence of sexual violence within pornographic content. Depending on the definitions used, the prevalence of sexual violence varied from 1.9% to 88.2% (McKee, 2005; Bridges *et al.*, 2010). A study analysing video titles of xHamster, Pornhub, and XVideos found that one in eight titles displayed to first-time users on the homepage depicts sexual activities classified as sexual violence (Vera-Gray *et al.*, 2021). Another study of heterosexual scenes from Pornhub and XVideos found that 45% of scenes on Pornhub and 35% of scenes on XVideos featured at least one instance of physical aggression. The most frequent types of physical aggression were spanking, gagging, slapping, hair pulling, and choking (Fritz *et al.*, 2020).

Research consistently demonstrates that pornographic content depicting violence is predominantly perpetrated by males against females (McKee *et al.*, 2008; Bridges *et al.*, 2010). Findings show that pornography use may foster the perception that violence, especially against women, is acceptable (Hald *et al.*, 2010; Malamuth *et al.*, 2012; Vera-Gray *et al.*, 2021). The view that pornography objectifies and dehumanises individuals through the depiction of abuse and violence forms the basis for perceiving pornography as a contributor to violence (Willis *et al.*, 2022).

Stereotypes

It is evident that pornography still portrays significant stereotypes. The issue with these stereotypical portrayals is that they furnish viewers with specific cognitive scripts, which have the capacity to influence their beliefs, actions, and behaviours. For instance, black women are more frequently targeted with aggression than white women, while black men are more likely to be displayed as the perpetrator (Fritz *et al.*, 2021). On numerous prominent online pornography websites (for example, xHamster, XNXX and XVideos), a dedicated category exists for pornographic content centred on Asian women. By using ethnicity as a category label, this type of pornography could significantly shape viewers' perceptions and attitudes toward the sexuality of Asian women. Asian women are repre-

sented sexually passive in online pornography and thus serves the stereotype that Asian women are demure (Zhou and Paul, 2016).

Previous research have used three key indicators - body display, reciprocity, and power dynamics - to examine gender (in)equality in pornographic content. Studies indicate that pornographic materials place greater focus on the sexualised body parts of women compared to those of men and is seen as treating women as mere objects (Gorman *et al.*, 2010). Researchers have highlighted the lack of reciprocity in pornographic content. That is to say, studies have indicated that pornographic content predominantly centers on satisfying men's sexual desires, often overlooking the sexual needs and gratification of female participants (McKee, 2005; Klaassen and Peter, 2015). Men are more likely to be shown in dominant positions, whereas women are more likely to be shown in degrading, submissive roles, which illustrates the power imbalance between men and women in pornographic content (Gorman *et al.*, 2010; Klaassen and Peter, 2015). Overall, this may contribute to detrimental beliefs about women.

5.3.2 Access by minors

Risk category (d) of Article 34 of the DSA encompasses the protection of minors and therefore according to the European Commission the prevention of minors to access pornographic content. A number of studies have analysed the association between the consumption of pornographic content by minors and components such as characteristics, attitudes or behaviours. However, given the complexity of conducting experiments in this area and the limited implementation of methodologies to estimate causal effects in this setting, the observed effects are more indicative of correlations than causal effects. For instance, minors exhibiting specific characteristics may be more prone to viewing pornographic content, and these characteristics may also lead to other outcomes. However, this does not imply a causal relationship between the consumption of pornographic content and the outcomes in question.

Effects

The majority of components associated with the consumption of pornographic content by minors have been classified as negative. It was found that the consumption of pornographic content by minors was associated with stronger gender-stereotypical and less progressive sexual beliefs (Peter and Valkenburg, 2016; Horvath *et al.*, 2013; Koletić, 2017). Moreover, pornographic usage was also found to be related to an increased propensity for sexual risk-taking behaviours, such as the absence of contraceptive utilisation (Wolak *et al.*, 2007; Smith *et al.*, 2016; Paulus *et al.*, 2024). Furthermore, pornography consumption has been associated with diminished self-esteem, with girls frequently reporting a tendency to compare themselves to the bodies depicted in adult online content, and feelings of fear regarding unrealistic expectations; boys fear they may not be as virile or able to perform as the men in the pornographic content (Owens *et al.*, 2012; BBFC, 2020).

It was also observed that minors often seek information from adult content (Peter and Valkenburg, 2016; BBFC, 2020; Paulus *et al.*, 2024). This phenomenon is particularly salient among queer individuals, who frequently encounter a paucity of sexual information in sex education that predominantly focuses on cis-heterosexual interactions (BBFC, 2020; Bøthe *et al.*, 2019). Nevertheless, the information obtained from adult online content has also been linked to adverse outcomes, including causing minors to feel compelled to engage in sexual activities, often without possessing the necessary knowledge to perform such acts safely and in some cases, coercing their partners into participating. (Marston and Lewis, 2014; Martellozzo *et al.*, 2016; BBFC, 2020). In addition, a greater proportion of individuals who view pornography intentionally possess a misguided comprehension of consent in comparison to those who do not do so, thus further illustrating how pornography may teach minors false information about sexual matters (BBFC, 2020).

It appears to be the case that the consequences of exposure to pornography on minors are contingent on a number of variables, including the characteristics of the minor, the specific content consumed, and assumptions pertaining to the content, which may, for example, depend on the sex education the individual has experienced; however, further research is necessary in this area to achieve a more comprehensive understanding of the precise relationship between these variables (Peter and Valkenburg, 2016; Ballester-Arnal *et al.*, 2023). A notable distinction in the impact of pornographic content on minors appears to be whether access is intentional or unintentional. Unintentional viewing of pornographic material frequently results in minors feeling shocked, confused, grossed out and ashamed, but also some positive reactions were present (BBFC, 2020; Ballester-Arnal *et al.*, 2023). In general, unintentional consumption is more prevalent among younger minors (BBFC, 2020). It is evident that even when individuals engage in a deliberate search for pornographic content online, they may unintentionally encounter more extreme material than they had anticipated (BBFC, 2020).

To summarise, several negative outcomes have been associated with the consumption of pornographic content by minors. However, these are correlational and not causal effects. Nevertheless, some minors may benefit from consuming pornographic content by acquiring information that is otherwise inaccessible to them. However, a more comprehensive sex education could also facilitate this process while regulating the specific content consumed and concurrently providing information. It has been posited that if pornography did not include “sexually violent, racist and sexist content”, then the access of children to such material would be less of an issue, thereby emphasising the significance of the precise content that is consumed (McGlynn *et al.*, 2024). Further research on this topic is required, aiming to undertake a more neutral analysis by evaluating the potential adverse as well as beneficial outcomes (Peter and Valkenburg, 2016).

Prevalence

The existence of evidence pertaining to the prevalence of adult online content consumption by minors is contingent upon characteristics such as the age range studied and the

definition of pornography consumption (Peter and Valkenburg, 2016). The majority of studies indicate that a considerable proportion of minors have either deliberately or accidentally viewed pornography, both online and offline (Peter and Valkenburg, 2016; BBFC, 2020; Thurman and Obster, 2021; Thurman *et al.*, 2022; Robb and Mann, 2023). Research has indicated a positive correlation between age and the propensity to have viewed pornography, with approximately 50% of individuals under the age of 14 and approximately 75% of those under 18 in the UK and US having reported such exposure (BBFC, 2020; Robb and Mann, 2023). A lower number was attained in a study conducted on a sample of 15- to 17-year-old minors residing in France, with 53% of the subjects reporting that they had viewed sexually explicit videos or pictures (Thurman *et al.*, 2022). A study conducted on a sample of 14- to 17-year-olds in six European countries revealed that 59% of the minors surveyed reported having been exposed to pornography in the previous year (Andrie *et al.*, 2021). This figure varied across different countries, but remained consistently above 51%.

Regarding unintentional consumption, in the US, 29% of respondents reported having encountered pornography accidentally, with 63% of these respondents reporting that this had occurred within the previous seven days (Robb and Mann, 2023). A study conducted in the UK found that 62% of 11- to 13-year-olds who had encountered pornography reported more unintentional than intentional encounters, with this figure declining to 46% for 16- to 17-year-olds. Concerning frequency of consumption, the study on minors in the UK previously mentioned found that the frequency of contact with pornography is high, with 18% of 11- to 13-year-olds and 41% of 16- to 17-year-olds reporting having seen pornography in the last two weeks (BBFC, 2020). The study of French individuals aged between 15 and 17 revealed a median of six days since their most recent exposure to pornography (Thurman *et al.*, 2022). The study, conducted on a sample of 14- to 17-year-olds across six European countries, found that 24% of the subjects reported having been exposed to pornography at least once a week during the past year (Andrie *et al.*, 2021). This figure exceeded 19% in each of the individual countries.

Common sources for unintentionally encountering pornography include accidentally clicking on a link that redirects to pornographic content, being exposed to advertisements and pop-ups, being shown pornography by a friend and search engine results (BBFC, 2020; Robb and Mann, 2023; Ballester-Arnal *et al.*, 2023). Sources for intentional pornography viewing include image or video search engines, social media sites, video sites/platforms and dedicated pornography websites, the latter being of particular significance as they are often the source most frequently used (BBFC, 2020; Robb and Mann, 2023; Thurman *et al.*, 2022). The study undertaken in France also found that the last exposure to pornography was noticeably less distant in time when it came to pornographic websites in comparison to other sources (Thurman *et al.*, 2022).

Therefore, despite the variability of the precise figures according to the specific context, it is evident that exposure to pornography is prevalent among minors, with a high

frequency of contact. Furthermore, pornographic websites appear to play an important role in the access to pornography by minors, both intentionally and unintentionally.

5.3.3 Mental health

A significant body of research correlates viewing pornography with decreased emotional health. Although the correlation between pornography consumption and mental health factors is well-documented, the lack of longitudinal studies and experimental designs limits the ability to draw causal conclusions. Further, the interplay between pornographic use and mental health is complex and potentially bidirectional in terms of causality. Research suggests that pornography consumption may be both a consequence and a cause of mental health issues.

For instance, studies show that pornographic consumption is associated with the feeling of loneliness, which can lead to reduced life satisfaction (Butler *et al.*, 2018; Tian *et al.*, 2018; Smith and LeSueur, 2023). However, it is plausible that relationship issues caused by pornography use lead to increased loneliness, while at the same time, loneliness may drive individuals to consume pornography as a way of coping with emotional distress. This cyclical dynamic suggests that both loneliness and pornography use can exacerbate each other, creating a reinforcing loop where one amplifies the other (Butler *et al.*, 2018).

Several studies show that pornography use is associated with depression, anxiety, and stress (Camilleri *et al.*, 2021; Owens *et al.*, 2012). Further, adolescents who watch pornography are more likely to have depressive symptoms, less emotional bonding to caregivers like their parents and more conduct problems (Owens *et al.*, 2012). Moreover, pornography use has been linked to risky behaviors such as binge-drinking and drug use (Carroll *et al.*, 2008; Harper and Hodgins, 2016).

Pornographic use is also associated with a decrease in the person's self-esteem. A survey with more than 2,000 adults in the US found, that 78% of the respondents who had viewed pornography within the previous 24 hours expressed dissatisfaction with their physical appearance (Cox *et al.*, 2022). This was in contrast to 44% of individuals who had never watched pornography and 58% of those who had previously watched it, but not within the last 24 hours.

At the same time, pornography use may function as a mechanism for mood regulation and stress relief, indicating its role in emotional self-management and coping strategies. Some people may turn to pornographic use as a way to cope with negative emotional states, such as boredom, stress and depression, implying that these mental states may actually precede, rather than result from, pornography use. This dual function highlights the complexity of its effects on mental health (Qadri *et al.*, 2023).

Finally, research has highlighted the psychological burden faced by content moderators who are tasked with reviewing pornographic and other harmful material. Content moderators often experience severe psychological stress, including symptoms of secondary traumatic stress, anxiety, depression and burnout (Wohn, 2019; Steiger *et al.*, 2021;

Spence *et al.*, 2023). This is due to prolonged exposure to distressing content and the repetitive nature of this work. Some moderators have even reported developing post-traumatic stress disorder symptoms (Spence *et al.*, 2023). However, providing psychoeducation and trauma-informed care to content moderators has been shown to help alleviate some of the mental health challenges they face (Spence *et al.*, 2023).

5.3.4 Addiction

Pornography consumption has been associated with problematic behaviors, such as addiction, which can disrupt various aspects of daily functioning (Wetterneck *et al.*, 2012). Whereby, especially the online pornographic use has the potential for addiction due to the “triple A” factors accessibility, affordability, anonymity (De Alarcón *et al.*, 2019). However, addiction is influenced by a complex interplay of psychological, moral and contextual factors, which makes the empirical and academic evidence supporting a direct causal relationship weak.

Symptoms

Individuals with addiction experience incentive salience, a psychological phenomenon where their desire for certain “rewards” becomes disconnected from the actual enjoyment of those rewards. This theory highlights how addicts can intensely “want” something, even if they do not expect to like it, remember liking it, or find it enjoyable when obtained - unlike non-addicted individuals, whose desires and enjoyment are typically aligned (Smith and LeSueur, 2023; Gola *et al.*, 2017). While this is one possible criterion for addiction to internet pornography, a standardised diagnostic does not yet exist. The definition of what is truly problematic behavior remains challenging, since the distinction between normal and pathological behavior can differ greatly between individuals (Setyawati *et al.*, 2020; De Alarcón *et al.*, 2019).

The consequences of pornography addiction are wide-ranging. The compulsivity of pornography use does not only disrupt daily functioning but also impairs cognitive control, making it challenging for users to regulate their behaviors. For instance, problematic pornographic users may experience incentive salience (Smith and LeSueur, 2023), isolation (Green *et al.*, 2012), depression, anxiety and stress (Camilleri *et al.*, 2021), relationship problems/breakdowns (Duffy *et al.*, 2016), and/or compulsive and risky behaviors (Setyawati *et al.*, 2020; Yunengsih and Setiawan, 2021).

Prevalence

The employment of differing survey methods and definitions results in varying prevalence values of pornography addiction. According to previous research, the extent of pornographic addiction ranges from 1.8% to 9.8% (Ballester-Arnal *et al.*, 2017; Najavits *et al.*, 2014). A study of college students revealed that 8.6% of the sample were at risk of developing a pathological use of online pornography, but the actual pathological user

prevalence was only 1.8% (Ballester-Arnal *et al.*, 2017). A survey conducted among Australians aged between 16 and 69 years revealed that 4% of males self-identify as being addicted to pornography, whereas this figure is only 1% for females (Rissel *et al.*, 2017). A further study found that 8% met the criteria for online sexual compulsivity, aligning with findings from another study where 8% of users reported frequent pornography use as a source of suffering (Cooper *et al.*, 2001, 1999).

Factors that may predict problematic sexual behavior and pornography use across various groups include being male, young age, frequent use of the internet, experiencing negative mood states, and having a tendency toward sexual boredom and seeking novelty (Ross *et al.*, 2012; Ballester-Arnal *et al.*, 2017; Štulhofer *et al.*, 2016; Frangos *et al.*, 2011). Younger individuals are particularly susceptible to developing addictive behaviors related to problematic pornography use, as they are more vulnerable to stress, depression, and anxiety, and their limited coping mechanisms even increase this risk (Duffy *et al.*, 2016; Potenza *et al.*, 2017; Taylor and Gavey, 2020).

Therefore, pornography addiction is a topic that appears to affect a significant proportion of users, with noticeable effects. However, further research is needed to identify the precise conditions that favour the development of addiction

6 Possible and current mitigation measures against societal risks

The following section presents a range of potential measures against some of the aforementioned societal risks, along with an overview of measures that have already been implemented. The optimal solutions are contingent upon subsequent research outcomes, the requirements that wish or can to be imposed on the websites and additional trade-offs.

6.1 Age verification

Potential measures

As a first step, the group of people able to access pornographic websites can be restricted. The implementation of age-verification mechanisms can serve as a regulatory measure to restrict access to pornographic content by minors. Potential methods for age verification include self-declaration, verification by credit card, biometric authentication, analysis of online usage patterns, offline verification through means such as scratch cards, parental consent or vouching, verification by presenting identification documents and digital ID Negreiro (2023). The implementation of all these methods, except self-declaration, can be carried out by the providers themselves or by using specific third-party apps.

Each of these methods has its own advantages and disadvantages. Verification by credit card, biometric authentication, analysis of online usage patterns, parental consent or vouching as well as verification by providing identification documents and digital ID

are all associated with significant challenges for privacy protection since all of them require users to provide personal data to verify their age. The co-storage of personal data and information on the precise use of pornography may result in an increased requirement for secure data storage. Furthermore, self-declaration, biometric authentication and analysis of online usage patterns are particularly vulnerable to errors. Self-declaration can be very easily bypassed by minors. Whilst offline verification appears to be a suitable approach for addressing these issues, it is also susceptible to errors. To illustrate, a study undertaken in 2018 found that 40% of retail shops in Ireland illegally sold scratch cards used for lotteries to minors, thus highlighting the issues this method possesses in practice (Hilliard, 2019). Furthermore, while it may be more challenging for minors to circumvent verification mechanisms such as authentication via credit card, parental consent or vouching, verification through the submission of identification documents or digital ID, it remains possible (Titheradge and Croxford, 2021). Nevertheless, all of these methods would at least provide protection for minors unintentionally accessing pornographic content.

However, certain issues are identified in the utilisation of age-verification technologies in general. Problems with age-verification technologies include ineffectiveness due to minors being able to bypass these technologies using a VPN or the Tor Browser, limited scope due to legislation not covering all areas where minors might encounter pornographic content and displacement effects resulting in minors switching to other, less scrutinised websites or to the Dark Web should they encounter age verification technology. Several studies conducted among minors in the UK and France have found that at least 23% of respondents, and up to 69% of a particular study's sample of older minors, were aware of methods to bypass age verification technologies (BBFC, 2020; Thurman and Obster, 2021; Thurman *et al.*, 2022). In general, older minors were found to be more likely to be familiar with such methods.

As Blake (2019) point out, the implementation of effective age-verification technologies could be prohibitively expensive for small or niche websites, which would face closure if they were obliged to implement such verification. This would result in reduced competition, violate the freedom of expression and lead to diminished diversity, particularly as many smaller or niche websites serve as spaces for minority groups (Blake, 2019). Alternatively, placing the financial burden on consumers has its disadvantages as well, since different verification technologies might be used by providers, such that a significant financial burden might be placed on consumers, especially those from economically disadvantaged backgrounds (Yar, 2020).

Current practices

A survey of active online pornography users in the UK found that 71% of users had never proven their age when consuming online pornography, 81% of whom stated that they had never been asked to do so Ofcom (2023). Of those who were requested to verify their age, 90% of them were required to do so by means of self-declaration. The second

most prevalent age-verification method was verification via credit card at 23%, followed by verification via uploading identity documents at 17%. With regard to prevailing practices on nine popular pornographic websites, including four tube sites (Pornhub, XNXX, XVideos, xHamster), four webcamming sites (xHamsterLive, Stripchat, Chaturbate, LiveJasmin) and the interactive social site OnlyFans, it was found that all of these websites verify the age of their users when they access the site from Germany. In ten cases, self-declaration was used to verify the age of the individual. The sole exception to this was OnlyFans, which requires the creation of an account, including verification of majority through multiple methods, including the provision of identifying information, confirmations, payment details and documents (OnlyFans, 2024a). Consequently, the majority of pornographic websites seem to have adopted a mechanism that is very easily overcome, which is likely to only prevent unintentional access, but which is very easily implemented and does not pose challenges regarding privacy. Nevertheless, smaller websites lacking an age verification mechanism have also been observed.

6.2 Verification of uploaders and performers

Potential measures

At the second level, the group of people permitted to upload could be restricted, alongside the implementation of further checks during the uploading process, in order to address certain societal issues. Allowing only verified users to upload content may serve to limit the propagation of illegal content, since, if the uploader's identity is correctly verified, it is more probable that they will be prosecuted for uploading such content (Sanders *et al.*, 2023). Even if the uploader were to circumvent the verification system, this would serve to create additional barriers to the uploading of illegal content, provided that the verification mechanism is sufficiently robust. Furthermore, if content uploaders are verified, this may serve to protect their legitimate content from being removed on the basis of false claims (Blegen, 2023). Additionally collecting the consent and identity of all depicted persons can reduce the probability of CSAM and NCSM further, as even if the uploader is willing to take risks regarding the distribution of such content, it can be ascertained that all individuals are adults and consent to the distribution. In this instance too, it is imperative to ensure the adequate protection of the collected data.

Current practices

Regarding the current practices, on all Aylo content sharing platforms, including Pornhub, on xHamster, on Stripchat, on xHamsterLive, on LiveJasmin, on Chaturbate and on OnlyFans users need to undergo a verification process prior to uploading content (Aylo, b; xHamster, c; Stripchat, 2024a; xHamsterLive, 2024a; LiveJasmin, 2024; Chaturbate, 2024; OnlyFans, 2024c). All of these verification checks necessitate, at a minimum, the upload of an ID document; however, in certain instances, additional materials such as a selfie with the ID document or a video call for verification is required. On OnlyFans, it was

also noted that accounts from creators undergo periodic re-verification using selfies, on a rolling 30-day cycle (OnlyFans, 2024d). On XVideos, all users with an account that does not require verification are permitted to upload content (XVideos, a). Given that users of XVideos have the option of uploading their videos to “XVideos + Network”, which encompasses XNXX, it can be deduced that the same applies to XNXX (XVideos, 2024; XNXX, b). Moreover, information was found that the identity and consent of all individuals depicted in the explicit material on Pornhub, xHamster, Stripchat and OnlyFans is verified (Pornhub, f; xHamster, c; Stripchat, 2024a; OnlyFans, 2024c). Stripchat uses computer vision to identify live streams with hidden faces, notifying the human moderator team for re-verification (Stripchat, 2024a).

However, a study notes that 42% of surveyed content creators reported that current stringent ID requirements compelled them to remove legitimate content since, for example, the backs of co-performers’ IDs featured in older content is not available to them, as it was not required in the past (Franco and Webber, 2024).

6.3 Content moderation

Potential measures

At the third level, the content of people being allowed to upload can be moderated. Some parties have requested that all content undergo a vetting process prior to its availability on pornographic websites, as well as a review of the content already available, as this likely increases the likelihood of identifying illegal content (Gane *et al.*, 2024). Moreover, some parties have suggested that the real-time monitoring of livestreams may contribute to a reduction in the prevalence of illegal content (Webber and Franco, 2024). A variety of techniques can be employed for content moderation. In general, automation tools can reduce the emotional burden for content moderators, whilst also enhancing the efficacy of detection (Lee *et al.*, 2020). One such tool is the hashing of content that has been identified as being illegal, which eliminates the necessity for a visual inspection of the material when it is being re-uploaded (Hunn *et al.*, 2023). A plethora of additional technologies, for example based on AI, can be employed to increase efficiency, yet it is also noted that human moderators are still required due to their superior ability to understand context. In general, the decision as to which content should be removed when moderated is dependent on the prevailing legal circumstances, but also on which content the platforms permit in their terms of service.

Current practices

The pornographic websites Pornhub, XVideos, XNXX, xHamster, Stripchat and OnlyFans all note to use a combination of human moderators and automated tools in general. Pornhub, xHamster and OnlyFans all review all content before it is made available on their websites using automated tools and human moderators (Pornhub, f; xHamster, c; OnlyFans, 2024d). Stripchat employs a pre-moderation process for all content available on its

site (Stripchat, 2024a). As on this site, the main mediums are livestreams, the moderation mechanisms differ from those employed for pre-recorded videos, as the precise content cannot be known in advance. Consequently, Stripchat employs continual monitoring of livestreams, utilising computer vision technology to identify potentially detrimental content and issuing alerts to human moderators in real-time (Stripchat, 2024a). It appears that XVideos and XNXX do not engage in the practice of pre-moderation of all content.

With regard to the technologies employed, Pornhub, OnlyFans and xHamster all note the use of hashing technology for the identification and removal of known illegal content (Pornhub, 2024b; OnlyFans, 2024d; xHamster, c). Furthermore, the utilisation of AI is mentioned by several platforms. xHamster is utilising it to detect inappropriate content (xHamster, c). Pornhub employs AI software to estimate the age of performers and utilises Google Content Safety API to identify any unknown illegal material (Pornhub, 2024b). Stripchat and xHamster automatically scan text for content that could be harmful, for example by employing AI-ML tools to identify potentially harmful text messages on Stripchat (xHamster, c; Stripchat, 2024a). Other techniques include the transcription of audio content to identify banned words (Pornhub, 2024b), the utilisation of scanning technology to assist human moderators in determining content prioritisation for review (OnlyFans, 2024b) and the fingerprinting of all material removed from a website to prevent re-uploads (Pornhub, 2024a; xHamster, c). XVideos and XNXX do not disclose the precise technologies employed. Furthermore, many smaller pornographic websites do not provide information regarding their content moderation processes.

The number of employed moderators appears to be relatively small compared to the number for social media sites (Blegen, 2023). XVideos employs 43 FTEs for the purpose of content moderation (XVideos, d). Stripchat has a support and moderation team of 94 individuals, of which 41 are employed within the in-house moderation team (Stripchat, 2024a). Pornhub does not disclose the number of employed human moderators in its DSA transparency report, arguing that all content is subject to review and that no content review quotas exist, thus the number of human moderators only influences the speed at which content is published on Pornhub (Pornhub, 2024a).

In order to provide a more detailed illustration of the current practices, the voluntary transparency reports of Pornhub are regarded as an exemplary source of information, since they provide extensive data. Pornhub stated that of all content uploaded during the initial six months of 2024, a total of 6.6% was either blocked during the upload process or removed within the same period (Pornhub, f). Of these, 2.8% were attributed to incomplete verification of co-performers. A total of 82% of the videos uploaded and removed or blocked during the initial six months of 2024, received no views, suggesting that they were blocked prior to upload; in 2021, this figure was 69% (Pornhub, f,b). During this period, 95% of all removals were attributed to internal detection; in 2021 this figure was only 73% (Pornhub, f,b). With regard to the subcategories of CSAM and NCSM, 54% and 63% of all removals or blocks in the first half of 2024, respectively, were detected due to internal moderation. For these categories, 99% and 27% of the content removed or blocked

during the first half of 2024 that was also uploaded during that time, respectively, were detected due to internal moderation. Overall, this suggests that significant enhancements have been made to Pornhub's content moderation practices in recent years. Furthermore, it underscores the challenges associated with identifying NCSM in comparison to CSAM through internal moderation, as a given situation may appear to be consensual, yet the act of sharing is not.

Some content creators have issued critiques regarding the current moderation practices of pornographic websites that employ a stricter moderation policy. To illustrate, the permissibility of content is contingent on its apparent content, rather than its actual circumstances; content that is consensual in nature, yet appears to be otherwise, is not permissible. (Webber and Franco, 2024). However, as previously mentioned, other parties have also argued that even the simulation of illegal content may have harmful consequences regarding the viewers' attitudes. Furthermore, it has been argued that the prohibition of several types of legal, consensual kinky content has resulted in a reduction in the expression of diverse sexualities (Webber and Franco, 2024). Furthermore, some content creators posit that the content moderation facilitated by AI is excessively conservative, resulting in the overmoderation of content (Webber and Franco, 2024). Moreover, they contend that the existing tools do not facilitate effective appeal mechanisms for performers in cases of erroneous decisions (Franco and Webber, 2024).

6.4 Functionalities

Potential measures

As a last step, the functionality of websites can be modified to mitigate specific risks. One such example is the prohibition of downloads, which could help to prevent the spread and reappearance of any illegal material that has been uploaded to the website (Kristof, 2020). Even without download functionality, there are other ways to obtain the content, although these are likely to be more difficult to use.

Furthermore, the blocking of search results when searching for terms that refer to illegal content can prevent users from accessing such material. Several institutions maintain lists of relevant keywords for illegal content (Hunn *et al.*, 2023). Moreover, it appears that warning messages when searching for illegal content, such as CSAM, can further prevent some users from viewing that content (Smallbone and Wortley, 2017; Prichard *et al.*, 2024, 2022b). This warning message should also provide the user with access to support resources (Wortley *et al.*, 2024). A heterogeneous group of individuals watch CSAM and begin doing so via different avenues; for a proportion of these individuals, this intervention may prevent them from starting or continuing to watch it (Prichard *et al.*, 2022b). The evaluation of the implementation of a chatbot, which directed individuals to support services on Pornhub UK, in addition to the previously presented warning and direction to support services, has demonstrated that these support services were utilised by a small proportion of individuals searching for CSAM-related terms (Scanlan *et al.*, 2024). Fur-

thermore, these services have been associated with a decline in searches for CSAM and some users who have searched for CSAM and thereby encountered the warning have continued to access other, legal content on the site (Scanlan *et al.*, 2024). Warnings may also prevent the uploading of illegal content in certain cases (Prichard *et al.*, 2022a).

Furthermore, it was stated that the notice-and-takedown mechanisms should provide the option to specify the precise type of illegal content, such as NCSM, when using a menu-based interface (De Angeli *et al.*, 2023). A trade-off may exist between such an interface and a free-text widget with regard to minimal distress and optimal clarity (De Angeli *et al.*, 2023). The absence of the requirement to describe the crime in one's own words may result in a reduced burden for the reporting individual, but, in the case of the menu-based interface, the correct option was identified less frequently than it has been accurately described in the free text (De Angeli *et al.*, 2023).

Current practices

As previously outlined, the tube websites XVideos and XNXX offer a download functionality, whilst this is not the case with xHamster and Pornhub. On the considered web-camming sites, the functionality of recording the content is either non-existent or only available upon the performer's decision.

Blocking of search results is a common occurrence. In the instance of conducting a search on Pornhub or xHamster for keywords associated with the depiction of minors, warning messages are displayed and no content is returned. Pornhub further provides a link for a help resource. Both XVideos and XNXX also show no content, but no warning message is displayed. When conducting a search for the term "revenge porn", the same picture as above results. However, a search for the keyword "deepfake", which is related to NCSM, yields content being depicted on XVideos and XNXX.

In the context of the NCSM, a small-scale study of websites that frequently disseminated such content revealed that accurate reporting was only feasible in 16% of cases, while in 36% of instances, the content could not be reported at all (De Angeli *et al.*, 2023). In regard to current practices on popular pornographic websites, Pornhub's content removal request form makes a distinction between between "Abusive or Illegal Content" and "Copyright Infringement" and it is also asked whether the content is violating its Non-consensual content or CSAM policy. xHamster is providing eleven categories, including "Copyright Infringement / DMCA Notice and Takedown", "Depiction of Minors" and "Illegal Exposure Including Non-Consensual Content". XVideos and XNXX each offer six options, including "Child pornography", "Non-consensual" and "Underage". Stripchat and xHamsterLive are providing twelve categories, including one for CSAM and one for NCSM. Chaturbate has a total of eleven categories, one of which is related to CSAM. LiveJasmin does not provide any categories and only offers a free text box.

7 Conclusion and outlook

The choice of appropriate solutions to prevalent societal issues depends on the actions that can be requested from different types of websites, the measures that research identifies as most effective, and the necessary trade-offs — such as whether to give content creators more freedom or to enforce stricter rules on permitted content. It must be acknowledged that many individuals depend on pornographic websites for their income, and thus, any abrupt alterations in policies can have a profoundly detrimental impact on their lives (Franco and Webber, 2024). Consequently, significant alterations might be preferable to implement with a certain degree of lead time.

In the future, the role of AI is likely to increase further in this industry, thereby slightly altering the prevailing circumstances. The use of AI to generate videos portraying individuals engaging in actions they never actually performed, as well as the proliferation of deepfakes, continues to grow (Kaushal, 2023; Yarmel and Lang, 2024). Further, customised AI-generated pornography allows users to create their own pornographic content digitally and personalise it in unlimited ways, while drastically cutting down production costs. This content might be even more addictive than traditional pornography because it can be efficiently created and customised using machine learning algorithms that analyse, with unprecedented precision, which specific features drive certain individuals to continue consuming it (Yarmel and Lang, 2024). Moreover, consumers are vulnerable to the impact of AI algorithms on commercial platforms, which steer them towards more intense and stimulating types of pornography (Sharpe and Mead, 2021; Wéry and Billieux, 2016).

There is a risk that the misuse of deepfake technology will increase, while AI moderation techniques will need to be further improved to detect and remove illegal content. Legal frameworks and public debate surrounding consent, data protection, and ethical responsibility are expected to gain greater importance in the coming years (Kaushal, 2023). Overall, it can be anticipated that the pornography industry will continue to integrate AI as a means to enhance efficiency, customise content, and strengthen customer engagement. At the same time, the call for stricter regulation and higher ethical standards is growing.

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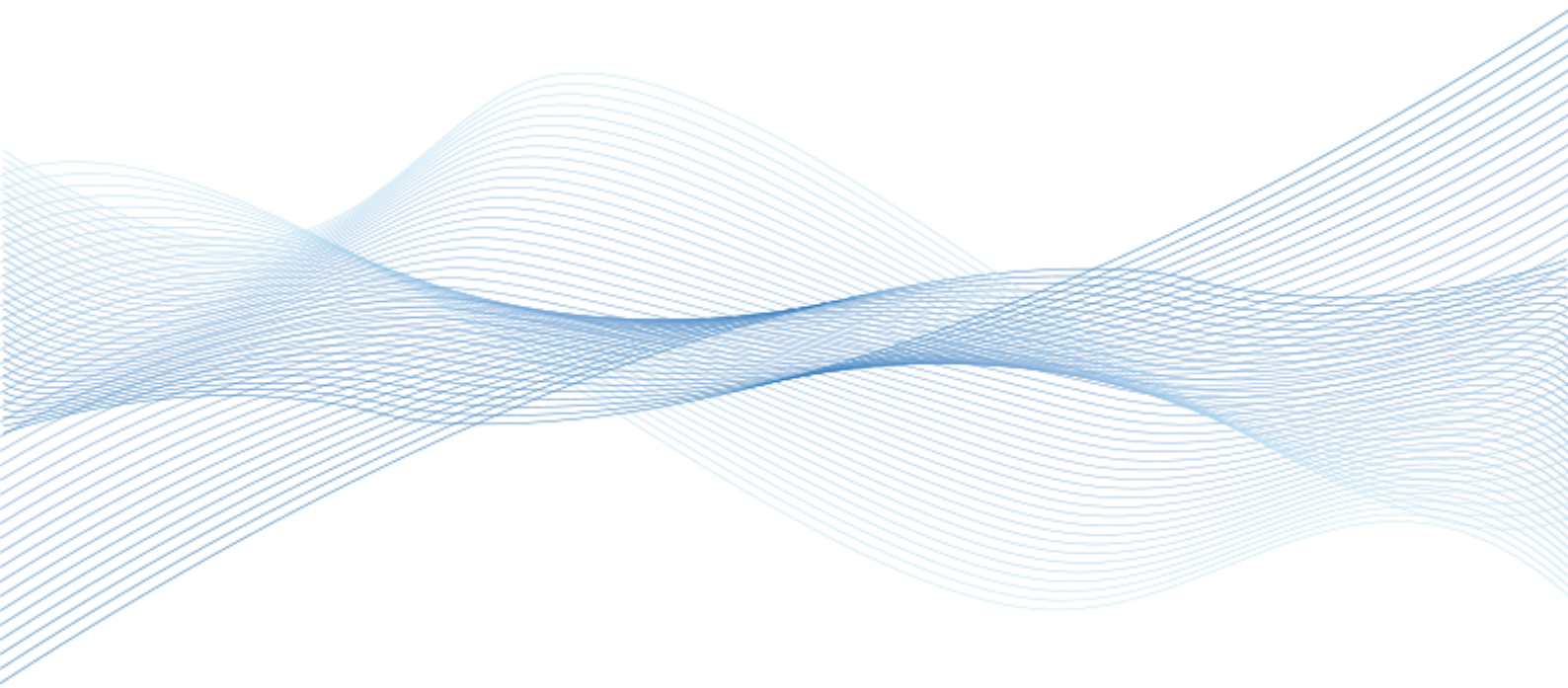
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