

Understanding the Incel Community on YouTube

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Abstract

YouTube is by far the largest host of user-generated video content worldwide. Alas, the platform also hosts inappropriate, toxic, and/or hateful content. One community that has come into the spotlight for sharing and publishing hateful content are the so-called Involuntary Celibates (Incels), a loosely defined movement ostensibly focusing on men’s issues, who have often been linked to misogynistic views.

In this paper, we set out to analyze the Incel community on YouTube by focusing on the evolution of this community over the last decade and understanding whether YouTube’s recommendation algorithm steers users towards Incel-related videos. We collect videos shared on Incel-related communities within Reddit, and perform a data-driven characterization of the content posted on YouTube. Among other things, we find that the Incel community on YouTube is getting traction and that during the last decade the number of Incel-related videos and comments rose substantially. Also, we quantify the probability that a user will encounter an Incel-related video by virtue of YouTube’s recommendation algorithm. Within five hops when starting from a non-Incel-related video, this probability is 1 in 5, which is alarmingly high as such content is likely to share toxic and misogynistic views.

1 Introduction

While YouTube has revolutionized the way people discover and consume video content online, it has also enabled the spread of inappropriate and hateful content.

One fringe community that has been particularly active on YouTube is the so-called Involuntary Celibates, or *Incels* [31]. While not particularly structured, Incel ideology revolves around the idea of the “blackpill,” a bitter and painful truth about society, which roughly postulates that life trajectories are determined by how attractive one is. For example, Incels often deride the so called rise of “lookism,” where things that are in large part out of personal control, like facial structure, are more “valuable” than those that are under our own control, like the fitness level. Taken to the extreme, these beliefs can lead to a dystopian outlook on society, where the only solution is a radical, potentially violent shift towards traditionalism, *especially* in terms of the role of women in society [8].

Incels are one of the most extreme communities of the Manosphere [4], a larger collection of movements discussing men’s issues [16]. The Incel ideology is driven by the sexual frustration of its subscribers who seek a community of like-minded people. Compared to other radical ideologies, Incels are disarmingly honest about what is causing their grievances. This fact renders their radical movement comparatively more persuasive and insidious [34].

Incel ideology has been linked to multiple mass murders and violent offenses. In May 2014, Elliot Rodger killed six people (and himself) in Isla Vista, CA. This incident was a harbinger of things to come. Rodger uploaded a video on YouTube with his “manifesto,” as he planned to commit mass murder due to his belief in what is now generally understood to be Incel ideology [50]. He served as an apparent “mentor” to another mass murderer who shot nine people at Umpqua Community College in Oregon the following year [46]. In 2018, another mass murderer killed nine people in Toronto, and after his interrogation the police claimed he had been radicalized online by Incel ideology [7]. Thus, while the concepts underpinning Incel ideology may seem “just” absurd, they also have grievous real-world consequences [20, 38, 5].

Online platforms like Reddit became aware of the problem and banned several Incel-related communities on the platform [19]. However, the Incel community migrated in various online platforms, in a loosely connected network of subreddits, blogs, forums, and YouTube channels. So far, the research community has mostly studied the Manosphere, and the Incel community in particular, on Reddit, 4chan, and online discussion forums like Incels.me [11, 37, 25, 42, 34]. However, given the fact that YouTube has been repeatedly accused for user radicalization and for promoting offensive and inappropriate content [45, 36, 43], a study on the Incel community on YouTube is imperative and can shed light on the extent Incels are exploiting the platform to spread their views.

With this motivation in mind, this paper explores the footprint of the Incel community on YouTube. More precisely, we identify and set to answer the following research questions:

1. **RQ1:** How has the Incel community grown on YouTube over the last decade?
2. **RQ2:** Does YouTube’s recommendation algorithm contribute to steering users towards Incel communities?

To answer these questions, we collect a set of 18K YouTube videos shared on Incel-related subreddits (e.g., /r/incels, /r/braincels, etc.), as well as 18K random videos for sanity check. We then build a lexicon of 200 Incel-related terms via manual annotation, using expressions found on the Incel Wiki. We use the lexicon to label videos as Incel-related, based on the appearance of terms in the title, tags, description, and comments of the videos. Next, we use several tools, including temporal analysis, and graph analysis, to investigate the evolution of the Incel community on YouTube and whether YouTube’s recommendation algorithm contributes to steering users towards Incel content.

Overall, our study leads to the following interesting findings:

- We find an increase in Incel-related activity on YouTube over the past few years and in particular in the publication of Incel-related videos, as well as in comments that include related terms. This indicates that Incels are increasingly exploiting the YouTube platform to spread their views.
- By performing random walks on YouTube’s recommendation graph, we find that, with 18.8% probability, a user will encounter an Incel-related video within five hops if they start from a random non-Incel-related video posted on Reddit. At the same time, we find that Incel-related videos are more likely to be recommended within the first two to four hops than in the subsequent hops. This means that a user casually browsing YouTube is *unlikely* to end up in a region of the YouTube recommendation graph that consists largely of Incel-related videos.

Paper Organization. The rest of the paper is organized as follows. The next section presents an overview of Incel ideology and the Manosphere, as well as, a review of the related work. Section 3 provides information about our data collection and video annotation methodology, while Section 4 analyzes the evolution of the Incel community on YouTube. Section 5 presents our analysis of how YouTube’s recommendation algorithm behaves with respect to Incel-related videos. Finally, we discuss our findings and conclude in Section 6.

2 Background & Related Work

In this section, we provide background information about Incels and the Manosphere. Also, we review related work focusing on understanding Incels on the Web, harmful activity on YouTube, and YouTube’s recommendation algorithm.

The Manosphere. Incels are a part of the broader “Manosphere,” a loose collection of groups revolving around a common shared interest in men’s rights in society. While we focus on Incels, it is worth understanding the Manosphere to get broader picture. Although the Manosphere had roots in academic-style feminism [35, 12], it is ultimately a *reactionary* community, with its ideology evolving and spreading mostly on the Web. [6] analyze this belief system from a sociology perspective and refer to it as masculinism. They conclude that masculinism is: “a trend within the anti-feminist counter-movement mobilized not only against the feminist movement,

but also for the defense of a non-egalitarian social and political system, that is, patriarchy.” [9] argue, with respect to the growth of feminism: “If women were imprisoned in the home [...] then men were exiled from the home, turned into soulless robotic workers, in harness to a masculine mystique, so that their only capacity for nurturing was through their wallets”. Subgroups within the Manosphere actually differ quite a bit. For instance, Men Going Their Own Way (MGTOWs) are more hyper-focused on a particular set of men’s rights, often in the context of a bad relationship with a woman.

Overall, the majority of research studying the Manosphere has been mostly theoretical and/or qualitative in nature [21, 16, 29, 18]. This is particularly important because it provides guidance for our study in terms of framework and conceptualization, while it motivates large-scale quantitative work like ours.

Incels. Incels are, to the best of our knowledge, the most extreme subgroup of the Manosphere [4]. Incel ideology differs from the other subgroups in the significance that the “involuntary” aspect of their celibacy has. They believe that society is rigged against them in terms of sexual activity, and there is no personal solution to systemic dating problems for men [22, 41]. Further, Incel ideology differs from, for example, MGTOW ideology, in the idea of *voluntary* vs. *involuntary* celibacy. MGTOWs are *choosing* to not partake in sexual activities. Incels, on the other hand, believe that society adversarially deprives them of sexual activities. This difference is crucial, as it gives rise to some of their more violent tendencies [16].

Incels believe to be doomed from birth to suffer in a modern society where women are not only able, but encouraged, to focus on superficial aspects in potential mates; e.g., facial structure, or racial attributes. Some of the earliest studies of “involuntary celibacy” note that celibates tend to be more introverted, and that, unlike women, celibate men in their 30s tend to be *lower* class or even unemployed [27]. In this distorted view of reality, men with these desirable attributes (colloquially known as *Chads*) are placed at the top of society’s hierarchy. While a perusal of powerful people in the world would perhaps lend credence to the idea that “handsome” white men are indeed at the top, Incel ideology takes it to the extreme.

Incels rarely hesitate to call for violence. This is often expressed in the form of self-harm, for example, “roping” (to hang oneself), however, it also approaches calls for outright gendercide. [53] associate Incel ideology with white-supremacy, highlighting how Incel ideologies should be taken as seriously as other forms of violent extremism.

Incels and the Web. [32] performs a qualitative study of how Reddit’s algorithms, policies, and general community structure enables, and even supports, toxic culture. She focuses on the #GamerGate and Fapping incidents, both of which had primarily women victims, and argues that specific design decisions make it even worse for victims. For instance, the default ordering of posts on Reddit favors mobs of users promoting content over a smaller set of victims attempting to have it removed. She notes that these issues are exacerbated in the context of online misogyny because many of the perpetrators are extremely techno-literate, and thus able to exploit more advanced features of social media platforms.

[11] perform the largest quantitative study of misogynistic language across the Manosphere on Reddit. They create nine lexicons of misogynistic terms which they use to investigate how misogynistic language is used in 6M posts from Manosphere related subreddits. Then, [25] study misogyny on the Incels.me forum, analyzing the language of users and detecting instances of misogyny, homophobia, and racism using a deep learning classifier that achieves up to 95% accuracy. [42] perform a large-scale characterization of multiple Manosphere communities and they find that older Manosphere communities, such as Mens Rights Activists and Pick Up Artists, are becoming less popular and active, while newer communities like Incels and Men Going Their Own Way are attracting more attention. They also find a substantial migration of users from the older communities to the newer ones, and that newer communities are actually more toxic and extreme ideologies.

Harmful Activity on YouTube. YouTube’s role in harmful activity has been studied mostly in the context of detection. [1] present a binary classifier trained with user and video features to detect videos promoting hate and extremism on YouTube, while [15] develop a k-nearest classifier trained with video, audio, and textual features to detect violence on YouTube videos. [26] investigate how channel partisanship and video misinformation affect comment moderation on YouTube, finding that comments are more likely to be moderated if the video channel is ideologically extreme. [47] use data mining and social network analysis techniques to discover hateful YouTube videos, while [39] analyze user comments and video contents on alt-right channels. [51] present a deep learning classifier for detecting videos that use manipulative techniques to increase their views (i.e., clickbait videos). [40, 48] focus on detecting inappropriate videos targeting children on YouTube, while [30] build a classifier to predict, at upload time, whether or not a YouTube video will be “raided” by hateful users.

YouTube Recommendations. [52] introduce a large-scale ranking system for YouTube recommendations that extends the Wide & Deep model architecture with Multi-gate Mixture-of-experts for multitask learning. The proposed model ranks the candidate recommendations taking into account user engagement and satisfaction metrics. [43] perform a large-scale audit of user radicalization on YouTube: they analyze videos from Intellectual Dark Web, Alt-lite, and Alt-right channels, showing that they increasingly share the same user base. They also analyze YouTube’s recommendation algorithm finding that Alt-right channels can be reached from both Intellectual Dark Web and Alt-lite channels.

3 Dataset

In this section, we present our data collection and annotation process for identifying Incel-related videos.

3.1 Data Collection

Aiming to collect Incel-related videos on YouTube, we look for YouTube links on Reddit, because of extensive anecdotal evidence suggesting that Incels are particularly active on the

Subreddit	#Users	#Posts	#Videos	Min. Date	Max. Date
ForeverAlone	86,670	1,921,363	6,761	2010-09	2019-05
Braincels	51,443	2,830,522	6,250	2017-10	2019-05
IncelTears	93,684	1,477,204	2,984	2017-05	2019-05
Incels	39,130	1,191,797	2,344	2014-01	2017-11
IncelsWithoutHate	7,141	163,820	550	2017-04	2019-05
ForeverAloneDating	27,460	153,039	465	2011-03	2019-05
askanincel	1,700	39,799	90	2018-11	2019-05
BlackPillScience	1,363	9,048	41	2018-03	2019-05
ForeverUnwanted	1,136	24,855	40	2016-02	2018-04
Incelselves	7,057	60,988	32	2018-07	2019-05
Truecels	714	6,121	22	2015-12	2016-06
MaleForeverAlone	831	6,306	11	2017-12	2018-06
foreveraloneteens	450	2,077	9	2011-11	2019-04
gymcels	296	1,430	6	2018-03	2019-04
SupportCel	474	6,095	3	2017-10	2019-01
IncelDense	388	2,058	3	2018-06	2019-04
Truefemcels	95	311	2	2018-09	2019-04
gaycel	43	117	1	2014-02	2018-10
Foreveralonelondon	19	57	0	2013-01	2019-01

Table 1: Dataset overview.

platform. We start by building a set of subreddits that can be confidently considered related to Incels. To do so, we inspect around 15 posts on the Incel Wiki [24] looking for references to subreddits, and compile a list¹ of 19 Incel-related subreddits. This list also includes a set of communities broadly relevant to Incel ideology (even possibly anti-incel like /r/Inceltears) to capture a broader set of relevant videos.

We collect all submissions and comments made between June 1, 2005 and April 30, 2019 on the 19 Incel-related subreddits using the Reddit monthly dumps from Pushshift [3]. We parse them to gather links to YouTube videos, extracting 5M posts including 18K unique links to YouTube videos. Next, we collect the metadata of each YouTube video using the YouTube Data API [17]. Specifically, we collect: 1) title and description; 2) tags; 3) video statistics such as the number of views, likes, etc.; and 4) the top comments, up to 1K, and their replies. Throughout the rest of this paper we refer to this set of videos, which is derived from Incel-related subreddits, as the “Incel-derived” videos.

Table 1 reports the total number of users, posts, linked YouTube videos, and the period of available information for each subreddit. Although recently created, /r/Braincels has the largest number of posts and the second largest number of YouTube videos. Also, even though it was banned in November 2017 for inciting violence against women [19], /r/Incels is fourth in terms of YouTube videos shared. Finally, note that most of the subreddits in our sample were created between 2015 and 2018, which indicates an increase in the popularity of the Incel community.

Control set. Additionally, we collect a dataset of random videos and use it as control, to capture more general trends on YouTube. To collect Control videos we parse all submissions and comments made on Reddit between June 1, 2005 and April 30, 2019 using the Reddit monthly dumps from Pushshift and we gather all links to YouTube videos. From them, we randomly select 18,294 links for which we collect their metadata

¹<https://tinyurl.com/list-of-incel-subreddits>

#Comments with Incel-related Terms in a Video	% Incel-related Comments	% Incel-related Videos
1	49.0%	20.0%
2	60.0%	36.0%
3	64.0%	42.0%
4	65.6%	44.0%
≥ 5	88.3%	62.0%

Table 2: Percentage of Incel-related comments and videos in random samples of videos that contain exactly 1, 2, 3, 4, or 5 or more comments with Incel-related terms.

using the YouTube Data API.

Ethics. Note, that we only collect publicly available data, make no attempt to de-anonymize users, and overall follow standard ethical guidelines [2, 10, 44]. In addition, our data collection fully complies with the terms of use of the APIs we employ.

3.2 Video Annotation

The analysis of Incel-related content on YouTube differs from the analysis of other types of inappropriate content on the platform. So far, there is no study in the literature suggesting the type or the main themes involved in videos that Incels are interested in, and this renders the task of annotating the actual video rather cumbersome. Besides being cumbersome, annotating the video footage does not by itself allow us to effectively study the footprint of the Incel community on YouTube. When it comes to this community, it is not only the content of the video that may be relevant. The language that the members of this community use in the discussions under videos for or against their views is also of interest. For example, there are videos featuring women talking about feminism, which are in turn heavily commented by Incels.

Hence, to capture all the different aspects of the problem we devise a video annotation methodology based on a lexicon of terms that are routinely used by members of the Incel community, and use it to annotate the videos in our dataset. To create this lexicon, we first crawl the “glossary” available on the Incels Wiki page [23], gathering 395 terms. Since the glossary includes several terms that can also be regarded as general purpose (e.g., fuel, hole, legit, etc.), we do manual annotation with three annotators to determine whether or not each term is specific to the Incel community. The annotators were told to consider a term relevant only if it expresses hate, misogyny, or it is directly associated to Incel ideology (e.g., “Beta male”) or any Incel-related incident (e.g., “supreme gentleman” – an indirect reference to the Isla Vista killer Elliot Rodgers [50]). Annotators are authors of this paper, they are familiar with scholarly articles on the Incel community and the Manosphere in general, and had no communication whatsoever about the task at hand.

We then create our lexicon² by only considering the terms annotated as relevant, based on the majority agreement of all the annotators, which yields a lexicon of 200 Incel-related terms. We also compute the Fleiss’ Kappa Score [14] to assess the

²<https://tinyurl.com/incel-related-terms-lexicon>

Subreddit	#Incel-related videos	#Other videos
ForeverAlone	358	6,403
Braincels	943	5,307
IncelTears	369	2,615
Incels	314	2,030
IncelsWithoutHate	88	462
ForeverAloneDating	9	456
askanincel	14	76
BlackPillScience	15	26
ForeverUnwanted	10	30
Incelfies	11	21
Truecels	5	17
MaleForeverAlone	2	9
foreveraloneteens	1	8
gymcels	5	1
IncelDense	0	3
SupportCel	1	2
Truefemcels	0	2
gaycel	0	1
Foreveralonelondon	0	0
Total (Unique)	1,773	16,521

Table 3: Overview of our labeled Incel-derived videos dataset.

agreement between the annotators, finding it to be 0.69, which is considered “substantial” agreement [28].

Next, we use the lexicon to label all the videos in our dataset. We look for these terms in the title, description, tags, and comments of the videos in our dataset. After inspecting the results, we find that most matches come from the comments. Hence, we decide to use the comments to determine whether a video is Incel-related or not. To select the lower bound of Incel-related comments that a video should contain to be labeled as “Incel-related,” we devise the following methodology:

1. We consider a comment as possibly Incel-related if it contains at least one Incel-related term;
2. We create sets of videos based on the number of Incel-related comments they contain – namely, exactly 1, 2, 3, 4, or ≥ 5 – and randomly sample 50 videos from each set;
3. The resulting 250 randomly sampled videos are manually checked, along with all their comments that contain Incel-related terms, by the first author of this paper to determine if the video itself contains content directly related to Incel ideology (e.g., it is produced by or it is a news story about Incels) or if the comments are likely posted by Incels (e.g., they express hate against women or physically attractive men).

Table 2 shows the results of this manual annotation process. For videos with less than five Incel-related comments, we find a lot of ambiguous examples of comments that are relevant to Incels but probably not posted by Incel users – e.g., “sounds like Alpha Dog,” “Alex Jones: Alpha Male Confirmed,” etc. We also observe that, as the number of considered Incel-related comments per video increases, so does the percentage of comments that are relevant to Incels and likely posted by them. We select five or more comments as a threshold as it delimits an acceptable percentage of comments probably posted by

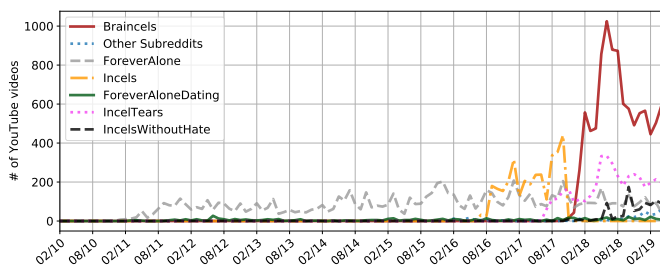


Figure 1: Temporal evolution of the number of YouTube videos shared on each subreddit per month.

Incels. Taking into account this threshold, we consider a video as “Incel-related” if it contains at least five Incel-related comments, otherwise we consider it as “Other.” Note, that an Incel-related video does not necessarily mean that the video itself is related to Incel ideology. It may be a benign video that is heavily commented on by Incels.

Table 3 shows the number of our labeled Incel-derived videos shared in each subreddit. Our final labeled dataset includes 1,773 Incel-related and 16,521 “other” videos in the Incel-derived set, and 477 Incel-related and 17,817 “other” videos in the Control set.

4 RQ1: Evolution of Incel community on YouTube

In this section, we present our temporal analysis that aims to shed light on the evolution of the Incel community on YouTube over the last decade.

4.1 Videos

We start by studying the “evolution” of the Incel communities in terms of the amount of videos they share. First, we look at the frequency with which YouTube videos are shared on various Incel-related subreddits per month; see Figure 1. We observe that, after June 2016, linking to YouTube videos becomes more frequent, and more so in 2018, and in particular on /r/Braincels. This likely indicates that the use of YouTube to spread Incel ideology is increasing.

In Figure 2, we plot the cumulative percentage of videos published per month for both Incel-derived and Control videos. While the increase in the number of “other” videos remains relatively constant over the years for both sets of videos, this is not the case for Incel-related videos, as 69% and 50% of them in the Incel-derived and Control sets, respectively, were published after December, 2014. Overall, we observe a steady increase in Incel activity, especially after 2016; this is particularly worrisome as we have several examples of users who were radicalized online and have gone to undertake deadly attacks [7].

4.2 Comments

Next, we study the commenting activity on both Reddit and YouTube. Figure 3(a) shows the number of comments

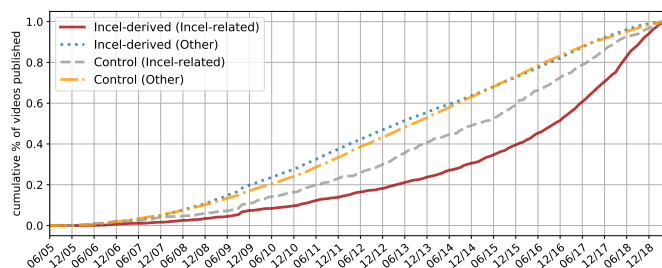


Figure 2: Cumulative percentage of videos published per month for both Incel-derived and Control videos.

posted per month for both YouTube Incel-derived and Control videos, and Reddit. Activity on both platforms starts to markedly increase after 2016 with Reddit and YouTube Incel-derived videos having much more comments than the Control videos. Once again, the sharp increase in the commenting activity over the last few years confirms the increased popularity of the Incel Web communities and, likely, their user base.

To further analyze this trend, we look at the number of *unique* commenting users per month on both platforms; see Figure 3(b). On Reddit, we observe that the number of unique users remains the same over the years, with an increase from 10K in August, 2017 to 25K in April, 2019. This is mainly because most of the subreddits in our dataset (58%) were created after the end of 2016. On the other hand, on YouTube, for the Incel-derived videos we observe a substantial increase from 67K in February, 2017 to 242K in April, 2019. An increase is also observed for the unique commenting users of the Control videos (from 57K in February, 2017 to 134K in April, 2019). However, it is not as sharp as the one of the Incel-derived videos (418% vs 729% increase in the average unique commenting users per month after January, 2017 in Control and Incel-derived videos, respectively).

To assess whether the sharp increase in unique commenting users of Incel-related videos is due to the increased interest by random users or due to an increased interest in those videos and their discussions by the same users over the years, we use the Overlap Coefficient similarity metric [49] to measure user retention over the years for the videos in our dataset. Specifically, we calculate the similarity of commenting users with those doing so *the year before*, for both Incel-related and “other” videos in the Incel-derived and Control sets. Note that if the set of commenting users of a specific year is a subset of the commenting users of the year before, or the converse, then the overlap coefficient is equal to 1. The results of this calculation are shown in Figure 4. Interestingly, for the Incel-derived set we find a sharp growth in user retention on Incel-related videos after 2014 while this is not the case for the Control. We believe that this might be related to the increased popularity of the Incel communities. Last, we believe that the higher user retention of “other” videos in both sets is due to the much higher proportion of “other” videos in each set.

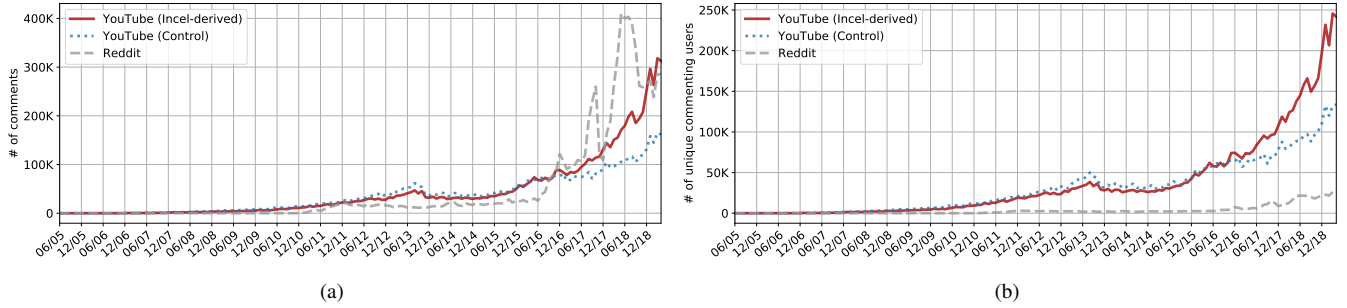


Figure 3: Temporal evolution of the number of comments (a) and unique commenting users (b) per month.

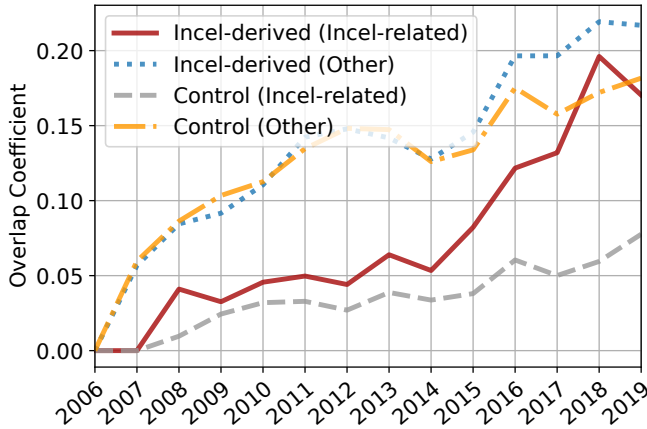


Figure 4: Self-similarity of commenting users in adjacent years for both Incel-derived and Control videos.

5 RQ2: Does YouTube’s recommendation algorithm steer users towards Incel-related videos?

In this section, we present an analysis of how YouTube’s recommendation algorithm behaves with respect to Incel-related videos: 1) we investigate how likely it is for YouTube to recommend an Incel-related video; and 2) we look at the probability of discovering Incel-related content by performing random walks on YouTube’s recommendation graph.

Recommendation Graph Analysis. To build the recommendation graphs used for our analysis, for each video in the Incel-derived and Control sets, we collect the top 10 recommended videos associated with it, as returned by the YouTube Data API. We manage to collect the recommendations for the Incel-derived videos between September 20, 2019 and October 4, 2019, and for the Control between October 15, 2019 and November 1, 2019. Note, that the use of the YouTube Data API is associated with a specific account only for the purposes of authentication, thus our data collection does not capture how specific account features or the viewing history affect recommendations. Instead, we analyze what the recommendation algorithm returns based on content, and general user engagement and satisfaction behaviors [52]. To annotate the collected videos we follow the same approach as described in Section 3.2.

Rec. Graph	Incel-related (%)	Other (%)
Incel-derived	7,196 (5.44%)	124,945 (94.55%)
Control	4,047 (2.58%)	152,642 (97.42%)

Table 4: Number of Incel-related and “other” videos in each recommendation graph.

Source	Destination	Incel-derived (%)	Control (%)
Incel-related	Incel-related	11,269 (2.25%)	2,044 (0.41%)
Incel-related	Other	26,641 (5.33%)	9,926 (1.99%)
Other	Other	432,659 (86.51%)	466,357 (93.64%)
Other	Incel-related	29,544 (5.91%)	19,714 (3.96%)

Table 5: Number of transitions between Incel-related and “other” videos in each recommendation graph.

Next, we build a directed graph for each set of recommendations, where nodes are videos (either our dataset videos or their recommendations), and edges between nodes indicate the recommendations between all videos (up to ten). For instance, if *video2* is recommended via *video1* then we add an edge from *video1* to *video2*. Throughout the rest of this paper, we refer to the collected recommendations of each set of videos as separate *recommendation graphs*.

First, we investigate the prevalence of Incel-related videos in each recommendation graph. Table 4 shows the number of Incel-related and “other” videos in each recommendation graph. For the Incel-derived recommendation graph, we find 125K (94.6%) “other” videos and 7K (5.4%) Incel-related videos, while in the Control recommendation graph we find 153K (97.4%) “other” videos and 4K (2.6%) Incel-related videos. These findings highlight that despite the fact that the proportion of Incel-related video recommendations in the Control recommendation graph is less, there is still a non-negligible amount recommended to users. Also, note that we reject the null hypothesis that the differences between the two recommendation graphs are due to chance via the Fisher’s exact test ($p < 0.001$) [13].

How likely is it for YouTube to recommend an Incel-related Video? Next, to understand how likely it is for YouTube to recommend an Incel-related video, we study the interplay between the Incel-related and “other” videos in each recommendation graph. For each video, we calculate the out-degree in terms of Incel-related and “other” labeled nodes. We can then

count the number of *transitions* the graph makes between differently labeled nodes. Table 5 summarizes the percentage of each transition between the different types of videos for both graphs. Unsurprisingly, we find that most of the transitions, 86.5% and 93.6%, in the Incel-derived and Control graphs, respectively, are between “other” videos, but this is mainly because of the large number of “other” videos in each graph. We also find a high percentage of transitions between “other” and Incel-related videos. When a user watches an “other” video, if he randomly follows one of the top ten recommended videos, there is a 6% and 4% probability in the Incel-derived and Control graphs, respectively, that he will end up at an Incel-related video. Interestingly, in both graphs, Incel-related videos are more often recommended by “other” videos than by Incel-related videos, but again this is due to the large number of “other” videos. The latter, possibly suggests that YouTube’s recommendation algorithm is not able to discern Incel-related videos, which are likely misogynistic, hence suggesting them to users.

Does YouTube’s recommendation algorithm contribute to steering users towards Incel communities? Next, we study how YouTube’s recommendation algorithm behaves with respect to discovering Incel-related videos. Through our graph analysis, we showed that the problem of Incel-related videos on YouTube is quite prevalent. However, it is still unclear how often YouTube’s recommendation algorithm leads users to this type of abhorrent content.

To measure this we perform experiments considering a “random walker.” This allow us to simulate the behavior of a random user who starts from one video and then he watches several videos according to the recommendations. The random walker begins from a randomly selected node and navigates the graph choosing edges at random until he reaches five hops, which constitutes the end of a single random walk. We repeat this process for 1,000 random walks considering two starting scenarios. In each scenario, the starting node is restricted to either Incel-related or “other” videos. The same experiment is performed on both the Incel-derived and Control recommendations graphs.

Next, for the random walks of each recommendation graph we calculate two metrics: 1) the percentage of random walks where the random walker finds at least one Incel-related video in the k -th hop; and 2) the percentage of Incel-related videos over all unique videos that the random walker encounters up to the k -th hop for both starting scenarios. The two metrics, at each hop are shown in Figures 5 and 6 for both recommendation graphs.

We observe that when starting from an “other” video, we find that there is a 20.9% and 18.8% probability to encounter at least one Incel-related video after five hops in the Incel-derived and Control recommendation graphs, respectively (see Fig. 5(a)). We also observe that, when starting from an Incel-related video, we find at least one Incel-related in 58.4% and 41.1% of the random walks performed on the Incel-derived and Control recommendation graphs, respectively (see Fig. 5(b)). We also find that, when starting from “other” videos, most of the Incel-related videos are found early in our random walks (i.e., at the first hop) and this number remains almost the same

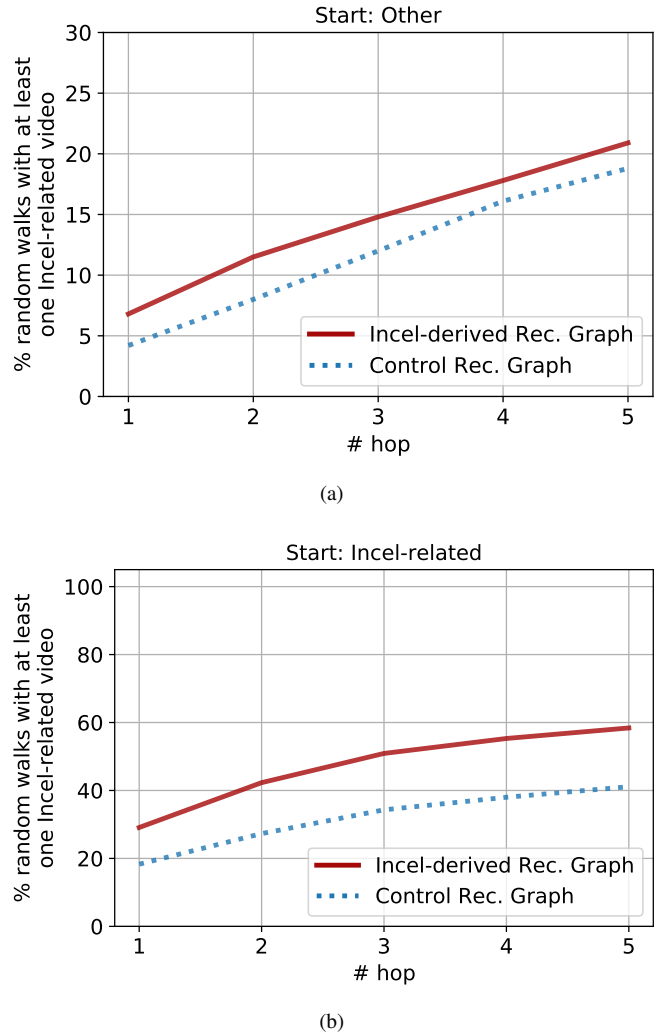
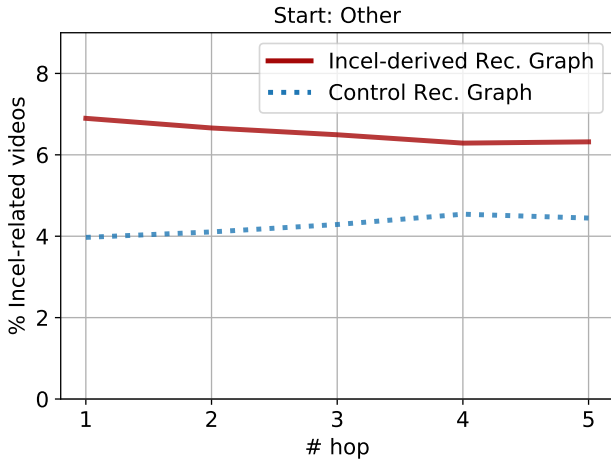


Figure 5: Percentage of random walks where the random walker encounters at least one Incel-related video for both starting scenarios.

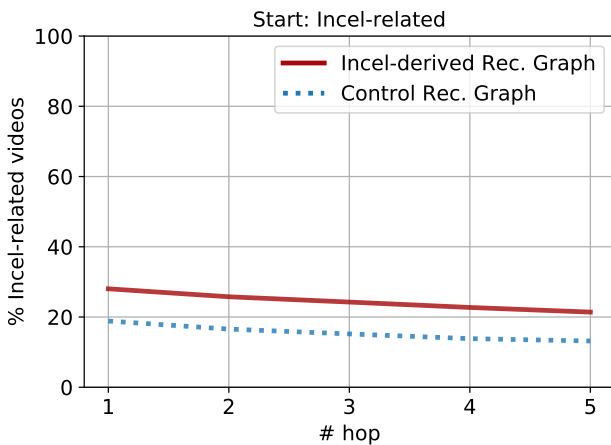
as the number of hops increases (see Fig. 6(a)). The same stands when starting from Incel-related videos, but in this case the percentage of Incel-related videos decreases as the number of hops increases for both recommendation graphs (see Fig. 6(b)).

As expected, in all cases the percentage of encountering Incel-related videos in random walks performed on the Incel-derived recommendation graph is higher compared to the random walks performed on the Control recommendation graph. We verify that the difference between the distribution of Incel-related videos encountered in the random walks of the two recommendation graphs is statistically significant via the Kolmogorov-Smirnov test ($p < 0.001$) [33]. Overall, we find that Incel-related videos are usually recommended within the two first hops. However, in subsequent hops the number of encountered Incel-related videos decreases. These findings indicate that a user casually browsing YouTube videos is unlikely to end up in region dominated by Incel-related videos.

Take-Aways. Overall, the analysis of YouTube’s recommendation algorithm yields the following findings:



(a)



(b)

Figure 6: Percentage of Incel-related videos over all unique videos that the random walk encounters at hop k for both starting scenarios.

1. We find a non-negligible amount of Incel-related videos (5.4%) within YouTube’s recommendation graph being recommended to users;
2. When a user watches an “other” video, if he randomly follows one of the top ten recommended videos, there is a 6% chance that he will end up watching an Incel-related video;
3. By performing random walks on YouTube’s recommendation graph, we find that when starting from a random non-Incel-related video, there is a 18.8% probability to encounter at least one Incel-related video within five hops.

6 Discussion & Conclusion

This paper presented a large-scale data-driven characterization of the Incel community on YouTube. We collected thousands of YouTube videos shared by users in Incel-related communities within Reddit and used them to understand how Incel ideology spreads on YouTube, as well as to study the evolution

of the Incel community. We found a non-negligible growth in Incel-related activity on YouTube over the past few years, both in terms of Incel-related videos published and comments likely posted by Incels. This suggests that users gravitating around the Incel community are increasingly using YouTube to disseminate their views.

Overall, our study is a first step towards understanding the Incel community and other misogynistic ideologies on YouTube. Taking into account the insights of our work and considering that the Incel community has been rarely characterized as an “emerging threat” for the society, we raise awareness for this movements and extreme ideologies. There is a need to protect potential radicalization “victims” by developing methods and tools that will aid the detection and suppression of Incel-related videos and other extreme activity on YouTube. At the same time, our analysis shows that there is a growth in Incel communities outside of YouTube (e.g., Reddit). This highlights that the Incel ideology is a cross-platform phenomenon that spans across multiple diverse Web communities. This diversity and conglomeration of the Incel ideology emphasizes the need to perform large-scale multi-platform studies to effectively understand emerging ideologies and movements like the one considered in this study.

Also, during this study, we analyzed how the YouTube’s recommendation algorithm behaves with respect to Incel-related videos. We found that there is a non-negligible chance (6%) that a user who watches a non-Incel-related video will end up watching an Incel-related video if they randomly follow one of the top ten recommended videos. By performing random walks on YouTube’s recommendation graph, we estimated a 20.9% chance of a user who starts by watching non-Incel-related videos to be recommended Incel-related ones within 5 recommendations.

Our results highlight the pressing need to further study and understand the role of YouTube’s recommendation algorithm in users’ radicalization and content consumption patterns. In an ideal scenario, a recommendation algorithm should avoid recommending potentially harmful or extreme videos, however, our results as well as previous work [43] shows that this is clearly a problem. We argue that there is a pressing need to tweak existing recommendation algorithms so that we can effectively put human-in-the-loop. That is, users should be able to provide feedback to the algorithm’s recommendations according to their views and interests. Then, the algorithm should refine the recommendations based on users’ feedback, hence improving the overall user experience and possibly making YouTube a safer platform.

Limitations. Our work has a couple of limitations. Specifically, our video annotation methodology is not perfect and there are some benign videos that may be considered Incel-related. However, due to the nature of the problem, annotating the actual video is somewhat cumbersome and does not by itself allow us to effectively study the footprint of the Incel community on YouTube. This is because, the misogynistic views of Incels may force them to heavily comment on a seemingly benign video (e.g., a video featuring a group of women discussing gender issues). Despite this limitation, we believe that our methodology

allow us to capture and analyze various aspects of Incel-related activity on the platform.

In addition, our work does not consider personalization and the video recommendations we collected only represent a snapshot of the recommendation system. More precisely, we analyze YouTube recommendations generated based on content relevance, and general user engagement and satisfaction behaviors. Given that we do not take personalization into account, it is hard to derive conclusions about YouTube at large. However, we believe that the recommendation graphs we obtain still allow us to understand how YouTube’s recommendation system is behaving *in our scenario*. Also note that a similar methodology for auditing YouTube’s recommendation algorithm has been used in previous work [43].

Future Work. We plan to extend our work by implementing crawlers that will allow us to simulate real users and perform random walks on YouTube with personalization. Note that this task is not straightforward as it requires understanding multiple characteristics of Incel, and based on that to build representative user profiles. These user profiles will allow us to understand the effect of personalization on the recommendation algorithm and perform more accurate data-driven studies on YouTube recommendation algorithm. We also plan to work towards detecting Incel-related content based on the video content, as well as looking into other Manosphere communities on YouTube (e.g., Men Going Their Own Way). For the latter, an interesting direction is to study how users migrate between Manosphere communities and other reactionary communities.

7 Acknowledgments

This project has received funding from the European Unions Horizon 2020 Research and Innovation program under the Marie Skłodowska-Curie ENCASE project (Grant Agreement No. 691025), and the CONCORDIA project (Grant Agreement No. 830927). This work reflects only the authors views; the Agency and the Commission are not responsible for any use that may be made of the information it contains.

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