Becoming a Supreme Gentleman

The dynamic radicalization process and violent behaviour of Incels

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1. Introduction

1.1 The history of Incels

When originally founded in 1990s, the Involuntarily Celibate (Incel) community was a non-violent online support group. Where young men and women, who struggled with relationships, could ask for dating advice. In the early 2000s, the Incel community had changed drastically into an aggressive and hate-driven environment. Now, Incels are often associated with sexism, extreme misogyny, and have been known to escalate in supporting and perpetrating violent attacks (Vink et al., 2023; Beauchamp, 2019; van der Veer, 2020; Salojärv et al., 2020). Hatred and violence against women is not new. Ever since the early 1900s, when women began fighting for equal rights, there has been resistance and violent retribution by men who feared for their dominant position in society. Various counter movements emerged to combat the Feminist waves. A prominent ideology was the Men's Rights Movements, which stated that women's empowerment would undermine men's masculinity (Kelly et al., 2021; Vink et al., 2023).

Misogynist and sexist beliefs, accompanied with gender violence, has been increasing. However, what makes Incels different from the typical misogynist ideology, is that they threaten violence against both women and men. Incels believe that rise of feminism and female equality is unnatural, it enrages them that women believe to be equal. That anger and hatred is aimed at women, the men who support feminism, and the men who benefit from the existing social order (Tomkinson et al., 2020; Lopes, 2023; O'Malley et al., 2022; Tietjes & Tirkkonen, 2023). The last decade has shown an increase in both members of the Incel community and violent Incel attacks. In North America, Incel members were responsible for the murder of at least fifty people between 2014 and 2018 (Vink et al., 2023). This has led to a growing concern about violent attacks stemming from Incels, as well as the justification of violence against women (Speckhard et al., 2021; Gheorghe, 2023). Even though not all Incel members pose a threat, the expanding community and motivated violence has led to a public security concern for authorities (Hoffman et al., 2020; Leidig, 2021).

1.2 Reference mode

The behaviour over time of *posts on Incel forums* show an increase over time. In the beginning there is a slow and stable growth, followed by a period of an increased rise of forum posts (Baele et al., 2023). The behaviour over time of *Incel members* also shows a steady growth in the early years. This is followed by a period of increased growth, a period of stabilization where existing Incels distance themselves from the ideology, and again an increase in Incel members (Baele et al., 2023; Speckhard et al., 2021). Lastly, the reference mode for *radical acts* starts with a stabilization, followed by a growth period and ends with an exponential growth. An increase in violence has been noted where more than 50 people were killed and hundreds were injured in Incel related attacks (ISD, 2021). This follows the broader trend of mass shooting where 50% of all the shootings occurring since the 2000s, 33% since 2010s and 20% in the last 5 years (Lindner, 2023).

The modes of behaviour show a problematic increase in the Incel community, as well as the acceptance and readiness to radical acts (see Figure 1). As Incels are part of an online community, which is mostly non-violent, the recent rise in violence is puzzling. There are many factors contributing towards the radicalization process and the acceptance for violence. However, there is less known how these factors interact with each other. System Dynamics offers an opportunity to study the radicalization and indoctrination process of Incels and to analyse the interconnectedness.
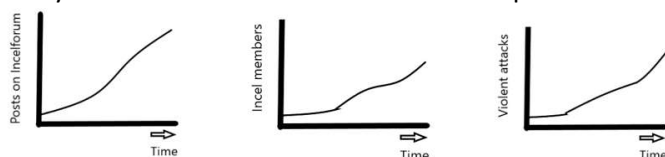

Figure 1. Reference mode

2. Dynamic Hypothesis

Regher (2022) defines the radicalization process of Incel as followed. There are susceptible individuals who are looking for likeminded people to deal with their *loneliness*. These are the people who visit Incel forums, but are not members yet. Often, the men who become *interested* in the Incel ideology have dealt with *bullying*, are struggling to fit in, and are at high risk of having *mental health issues* (Regher, 2022; Moskalenko et al., 2022). Due to the scope of this study, mental health issues will only include depression. Koehler identifies bullying, and other things that have had a negative impact, as one of the factors for *radicalization* (Koehler in Kersley, 2021). Regher (2022) further explains that in the radicalization process, when *interested* individuals become *Incels*, the loneliness is transformed into anger. Incels have misogynistic views and believe that Feminism is an oppressive ideology. The progress towards gender equality is believed to be the catalyst for the rise of the Inceldom. Incels become enraged by the fact that women see themselves not just as human, but as equal beings. These beliefs fuel anger and hatred within the Incel community, and that anger is aimed women and those who support equal rights (Lindner, 2022; Lopes, 2023; Sugiura, 2021; O'Malley et al., 2022). A small group of Incels will go through a further *extremization* process and become *Incel extremists*. These are the core members of the Inceldom who openly support and possibly commit *radical acts*. Incel extremists are the most active on *Incel forums* and generate the most *extreme Incel posts* (CCDH, 2022).

The online forums, and the echo-chamber that is the internet, subjects the members to a high dosage of anti-feminist and violent content and normalises these beliefs (Regher, 2022). The more Incel related posts that are being made, the higher the probability that susceptible will come into contact with Incel related beliefs and thus become interested in the Incel ideology. This also accounts for the higher probability of Incels further extremizing into Incel extremists, due to the normalization of extreme views and beliefs in these Incel posts.

The last step in the *radicalization* process is the martyrdom and the *glorification of mass killers*. These acts are encouraged, shared online, celebrated along *social media platforms* and encouraged even further. This cycle also promotes the acts of future violence (Regher, 2022). Martyrdom has been used to create and reinforce the ideologies of the movement, but also to attract new members to the cause (Laguna Serrano, 2020). Baele et al. (2023) has analysed the evolution of violent extremist language and posts across different Incel forums and over time. Spikes in the amount of posts have been observed after two major Incel attacks (the attacks perpetrated by Alex Minassian and Armando Hernandez). However, Baele et al. (2023) has also observed drops in the activity among Incel forums, indicating members leaving the forums. This reflects what Salojärvi et al. (2020) notes, that some members will leave if the community turns to violence, and aligns with the findings of Moskalenko et al. (2022) where 79% of the survey respondents rejected violence.

Moskalenko et al. (2022) further reveals that around a third of the surveyed Incels report that they have been *bullied or experienced persecution for being an Incel*. Being bullied or feeling persecuted are both risk factors that can lead to violence (Van Brunt & Taylor, 2021). This would mean that an Incel radicalizes even further into an Incel extremist. Other risk factors that have been identified for having a possible effect on the extremization process of becoming an Incel extremist *are loneliness and depression related to being an Incel*. Research of Speckhard et al. (2020) reports that spending more time on the Incel forums increases the feeling of depression. Problematic and excessive use of the internet can also increase feelings of loneliness (Maxwell et al., 2020), which confirms the findings that prolonged use of Incel forums do not lessen the feelings of loneliness in the long run (Tietjen & Tirkkonen, 2023). Feelings of loneliness and depression can, in extreme cases,

eventually lead to rising frustration. The increase in frustration can lead to anger focussed onto the people who have caused the hurt (Van Brunt & Taylor, 2021).

Another important part of the Incel extremization process is through *mass media exposure*. Mass media has an important role in informing the public and raising awareness on current events, like Incel related radical acts. However, Lounela and Murphy (2023) argue that the portrayal of "all Incels are violent extremists", which is often used by the media, can create harmful and dangerous stereotypes. Inciting further feelings of persecution amongst the Incel community. Tomkinson et al. (2020) describes how mass media reporting on Incels can encourage engagement in violence by those who feel like they are being persecuted. Furthermore, mass media exposure on Incels can lead to a *feminist response*. This is seen after the attack from Elliot Rodger when women banded together and shared their stories online (Blake, 2015). Or when a Canadian minister called out society to talk about misogyny after the Alek Minassian attack (CBC News, 2018). Seeing as Incels believe Feminism is something that must be fought against, a feminist reaction will fuel anger and hatred within the Incel community (Sugiura, 2021; O'Malley et al., 2022). This anger and frustration leads to likeminded interested men radicalizing into Incel members, and even further extremization into an Incel extremist. The Incel extremist who commits violence, does this as an attack on feminism and women.

The aim of this project is to describe the dynamic radicalization process of Incels. While the model is based on data from terrorism research, it is not meant as an exhaustive model. It looks at the most important feedback mechanisms. The Hybrid Stock and Flow displayed in Figure 2, is a comprehensible version of the actual model and table 1 explains the major feedback loops.

Figure 2. Hybrid Stock and Flow Diagram: the most significant feedback loops of the dynamic radicalization process
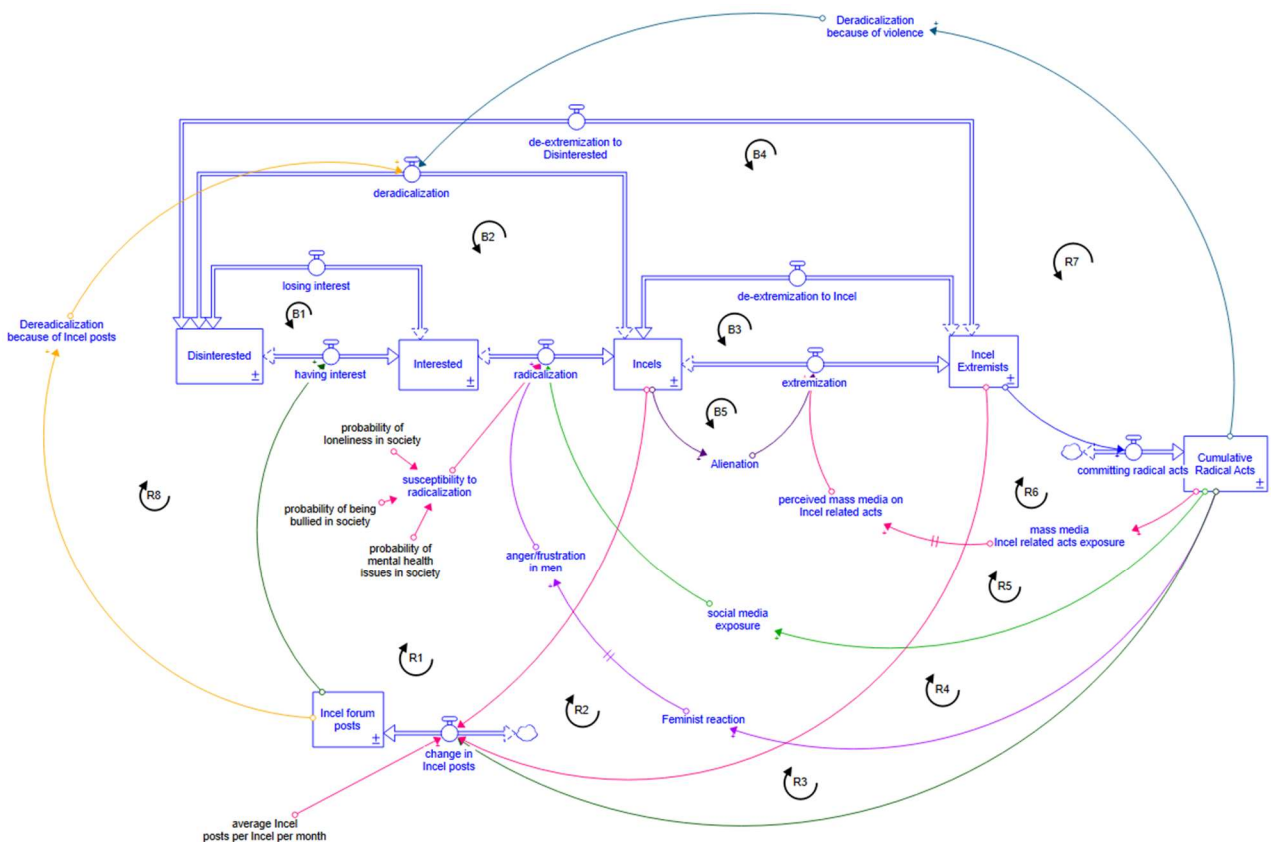
Table 1. The major feedback loops

B1: "Not interested"	This balancing loop shows how men on the internet can come into contact with Incel related content, become interested in the ideology, and then lose interest again.
B2: "Too much"	This loop show that some Disinterested people become Interested, and then radicalize into Incels. After some time, most of the Incels will eventually deradicalize and lose the ideology.
B3: "Take a step back"	Sometimes Incel Extremist partially de-extremize. They will no longer belief in the extreme violent views, but are still part of the wider Incel ideology.
B4: "Life changing"	Most Incel Extremist will eventually de-extremize and leave the Inceldom. They will become Disinterested, with a chance of becoming interested again and starting the cycle all over.
B5: "Us vs. Them"	This balancing loop displays the feelings of loneliness or persecution Incels might experience because of the Inceldom. This can make them more extreme in their beliefs and some will become extremists.
R1: "More Incels, more Posts"	This reinforcing loop shows that with more Incels, there will be more posts on the Incel forums. This increased the possibility of men on the internet seeing the content, and thus becoming interested in the ideology and possibly radicalizing into Incels themselves.
R2: "More Incel Extremists, also means more Posts"	Similar to R1, Incel extremists are responsible for the more extreme posts on the Incel forums. An increase in extremists means more overall posts and thus a higher probability of more people becoming interested in the Incel ideology and radicalizing into Incels and Incel Extremists.
R3: "Actions have consequences"	After a Disinterested became Interested, radicalized into an Incel and further extremized into an Incel Extremists, some of these extremists commit violence. These violent attacks result in more Incel posts being written, which in turn increases the possibility of random men coming into contact with the content and becoming interested.
R4: "Strong Women"	This reinforcing loop shows how an increase of violence will lead to a Feminist reaction, to defend others and challenge the narrative. This will in turn lead to more anger in some men. Since Incels are anti-Feminist, these men will find similar ideals within the community and radicalize into Incels.
R5: "Social media glorification"	This loop shows that radical acts are not only discussed on the Incel forums, but get additional exposure on social media. The glorification of martyrs and mass murders aids the radicalization process of Interested young men into Incels and for some even into Incel Extremists.
R6: "Media vilification"	When acts of violence are committed, the mass media brings attention to this. The exposure through mass media can lead to negative attention or reactions toward the Incel community. This can lead to Incels feeling attacked by society, and further extremizing into extremists.
R7: "Disillusion"	This loop describes how committing radical acts or reading about it can lead to feelings of disillusionment for Incels and Incel Extremists. This is the case when the violence does not amount to what was expected. Which can lead to de-radicalization and de-extremization. For the sake of simplicity, the lines are only on deradicalization. But it also applies to de-extremization to Incel and Disinterested.
R8: "Burnout"	Similar to R7, this loop describes how Incels and/or Incel Extremists can experience feelings of burnout after reading or generally being surrounded by Incel content. This can then lead to de-radicalization and de-extremization. For the sake of simplicity, the lines are only on deradicalization. But it also applies to de-extremization to Incel and Disinterested.

3. Analysis

3.1 Model Validation

In order to build confidence in the model, and thus in the results, various validations tests were conducted as illustrated in Barlas (1996). The tests will be briefly discussed, but for more details see Appendix A (model documentation) and B (sensitivity testing).

The **structure of the model** is based on findings from Incel and terrorism related research. Due to the scale and timeframe of the project only the loop structures determined to be the main feedback process for the Incel radicalization process were used. The **parameters** used in the model are either found in, or calculated based on, data from the literature. A more detailed overview on the parameters can be found in the model documentation. Furthermore, all the parameters are included because of their "real-world" meaning. This means that the model is **dimensionally consistent**.

The model was further tested using **extreme condition tests**, which resulted in fitting and expected behaviour. The last test was the **sensitivity analysis**, which was performed on all the parameters and the table functions. While the model is numerical sensitive, only one parameter led to a behaviour change which was in line with expectations and makes for a good leverage point for policies. The overall behaviour of the model remained the same throughout the analysis, which builds confidence in the model. A brief overview is given in table 2, but for further explanation see Appendix B.

Table 2. Results sensitivity analysis

Sensitivity	Parameters	Table functions
Numerical	17	3
Behavioural	1	0
Not significant numerical	12	6
Not sensitive	5	0

3.2 Simulation: Base run

The key performance indicators in this model are the total amount of Incel forum posts, Cumulative Radical acts, Incels and Incel Extremists. The graphs in Figure 3 show the simulation results of the baseline scenario, which match the reference mode.
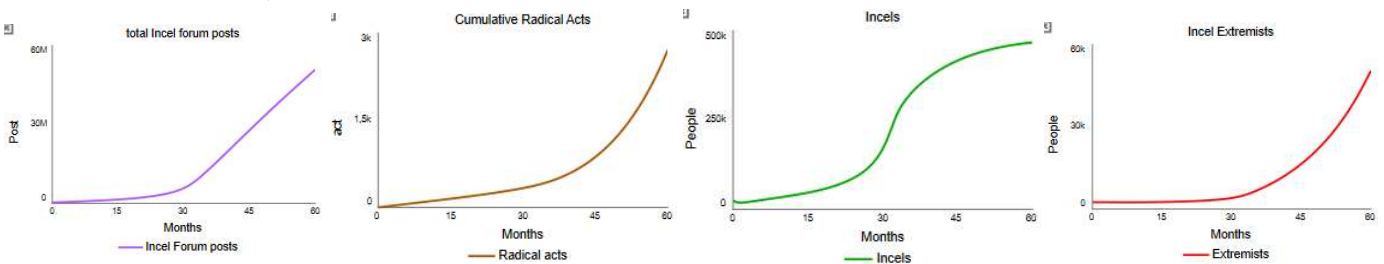

Figure 3. Base run key performance indicators

Overall, the four key performance indicators show a stable growth phase before increasing over time. Cumulative radical acts and Incel Extremist display exponential growth after around 30 months. The stock of Incels starts to increases increasingly just before the 30 months mark, then after 35 months starts to increase decreasingly. The total Incel forum posts displays what seems to be linear growth, but after further analysis is deemed to be goal-seeking growth. The behavioural patterns will be further analysed, with the focus on the feedback mechanisms responsible for the behaviour.
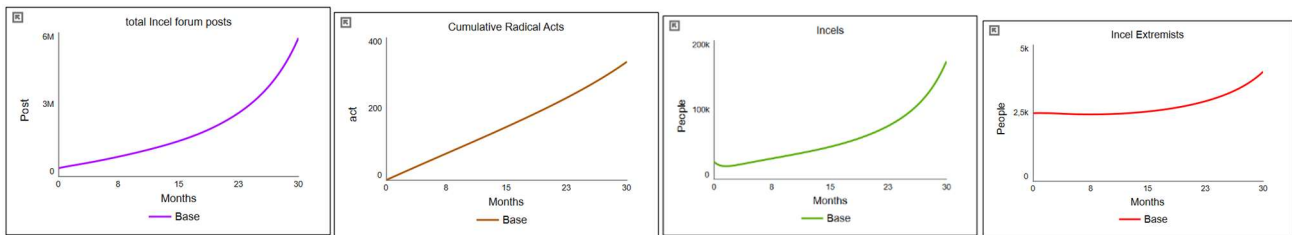
Figure 4. Base simulation month 0-30

At the very beginning, the balancing loop B1 "Not Interested" is dominant. This means that men have come into contact with Incel forum posts and have decided that they are not interested in the ideology. The men go from the "Interested stock" back to "Disinterested". Because of the initial dominance of the "Not Interested" loop, the loop of "Interested" men moving to the stock of "Incels" is counteracted. Less men radicalize into Incels, while the balancing loop B2 "Too Much" is gaining strength. This explains the initial small dip of Incels (see Figure 4), there are more men de-radicalizing back into "Disinterested", than there are men radicalizing into Incels. A decreasing amount of Incels means that there are less men who could extremize into an Incel Extremist. This, combined with the low probability of de-extremizing, explains the initial stabilization of the stock of Incel Extremists (see Figure 4). A decreasing stock of Incels also means that there are less Incel posts being made than there would be otherwise ("More Incels, More posts"), however because it takes time before the posts are forgotten, there is still a slow growth seen in the total Incel forum posts.

Because of the slow growth of the total Incel forum posts, the initial dominance of the B1 loop shifts to the reinforcing loop R1 "More Incels, More posts". With the steady growth of Incel forum posts, the probability of men becoming interested in the Inceldom increases, which then leads to the amount of Incels increasing. Because of the reinforcing feedback of R1, more Incels lead to more Incel forum posts, which then again leads to more men becoming interested and thus Incels. With more Incels there is also a small increase in Incel Extremists, and through the extremists in Radical acts. Because of the increase in radical acts, around month 15 a second reinforcing loop joins the loop dominance; R3 "Actions have consequences". This loop describes how the increase in indicated radical acts leads to an increase in forum posts being generated, this is noticed around month 20 when the total forums posts begin to increase increasingly. R3 compliments R1, and more generated forum posts increase the amount of Interested and eventually also Incels and extremists. Other reinforcing feedback loops also kick in because of the increase caused by the dominance of R1 and R3, namely R4 "Strong Women" and R5 "Social media glorification". More indicated radical acts lead to more social media glorification of violence and a strong feminist reaction against Incels. Because Incels are anti-feminist, a feminist reaction will lead to men who have the same anti-women values as Incels, radicalizing. Both "Strong Women" and "Social media glorification" have an amplifying effect on the probability of men radicalizing into an Incel. This is seen around month 20, when the stock of Incels begins to increase increasingly. After a short delay, so does Incel Extremists. With more extremists, there will be an even greater possibility for violence. Around month 25 the cumulative Radical acts seems to switch from a linear like growth, to a more increasingly increase (see figure 4).
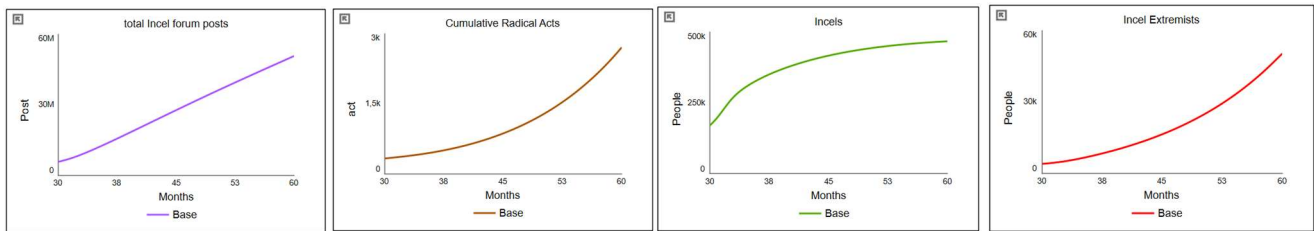
Months 30-60

Figure 5. Base simulation month 30-60.

While at the start of month 30, the "Strong Women" loop becomes the most dominant and boosts the probability of interested radicalizing into Incels, a tipping point is soon reached (see figure 5). The balancing loop B2 "Too Much" begins to counteract the "Strong Women" loop and weakens its strength through the increased deradicalization of Incels. B2 is being amplified by the effect that the increased radical acts has on the deradicalization process (R7: "Disillusion"). This leads to men leaving the Incel ideology behind and becoming "Disinterested" again. Figure 5 shows how the Incel stock begins to increase decreasingly. Because the growth of Incels is less than before, and there are relatively less Incels to make posts, the growth of the total Incel forum posts also changes from increasing increasingly to increasing decreasingly. While B2 "Too much" is dominant and removing possible Incel Extremists from the Incel stock, the balancing loop "Us vs. Them" and the reinforcing loop "More Incel Extremists, also means more Posts" are hampering this by boosting the probability of extremization. These two loops are responsible for the continued increase in extremists which is seen in the graph of Incel Extremists (see Figure 5). Because the amount if Incel Extremists keeps increasing, so does the stock of Cumulative Radical acts. Extremists are responsible for the violent attacks, so with more extremists there will be more radical acts.

At around month 40, the dominant balancing loop "Too Much" is accompanied by the balancing loop B1 "Not Interested". With more men deradicalizing from Incels to Disinterested, the Incel stock is being depleted while the Disinterested stock grows. The dominance then shifts from B2 to B1. More Disinterested men mean that there are more men who can become Interested in the Incel ideology, which in turn also mean that there are more men who can lose interest again ("Not Interested"). B1 remains the dominant loop until the end. However, the density of the Incel community is responsible for feelings of alienation which in turn has an amplifying effect in the probability of extremization. This combined with the added effect of Extreme Incel forum posts (the posts made by the Incel Extremists, which are still increasing), explains why Incel Extremists keeps increasing increasingly until the very end. Because even though the dominance has shifted and the growth has decreased, there are still a lot of Incels who have the chance of becoming an extremist.

Overall the balancing feedback loop B1 "Not Interested" plays an important role in the feedback mechanism. Eventually there will be some men radicalizing from Interested into Incels. The reinforcing loop "More Incels, More posts" then takes over the dominance and increases the amount of Incels and through that the Incel forum posts. This in turn helps the probability of radicalization to grow. With more Incels, there will be more Incel Extremists. The added effects of Radical attacks first helps to further increase Incels and extremists until the effects of radical acts on deradicalization take over and more Incel and extremists deradicalize back to Disinterested. Starting the cycle all over again.

3.3 Simulation: Banning posts

For this simulation, the effect of banning Incel Forum posts on the radicalization of Incels and Incel Extremists is tested. As described in the section of the base simulation, the existence of Incel forum posts aids the process of men becoming interested in the ideology, which increases the probability of men radicalizing into Incels and thus extremists. The more extreme Incel Forum posts in turn boost the probability of extremization. In order to hinder this, outflows are added to the stocks of (Extreme) Incel Forum posts to demonstrate the effect of banning posts. The graphs in Figure 6 show the results.

Figure 6. Simulation results of the base and the banning of posts
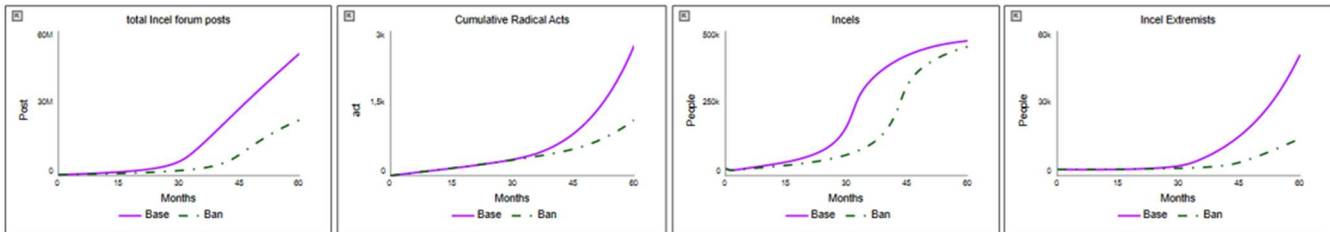
Overall, the behaviour pattern does not change. However the values for Total Incel forum posts, Cumulative Radical acts, and Incel Extremists are significantly lower (green dash-dotted line) compared to the base run (purple line). The rate at which Incels increase is slower than for the base simulation, but at the end reaches similar levels. The banning of Incel forum posts weakens the effect of the "More Incels, More posts" loop, and leaves the "Not Interested" loop stronger. Because there are less accumulated forum posts, the effect on the probability of becoming interested is less compared to the base scenario. It takes around 40 months for the Total Incel forum posts to start increasing increasingly, compared to around 30 months for the base. Since it takes a little longer for "More Incels, More posts" to become dominant, the initial growth of Incels also takes longer. When there are less Incels, there will be less Incel Extremists and thus less violence compared to the base scenario. When "More Incels, More posts", does become dominant the stock of Incels increases increasingly, this growth is then amplified by the effect of "Social media glorification" and "Strong Women", because the radical acts still increase albeit slowly.

3.4 Simulation: Mental Health Services

For this scenario, a method to prevent men from radicalizing into Incels is tested. Based on the performed sensitivity analysis (see Appendix B), the effect of mental health services is tested. To account for men going to therapy or seeking different kind of help for their depression or more general mental health issues, the parameter "probability of mental health issues in society" is lowered to a value of 0.1. The graph in Figure 7 display the results of this simulation run.

Figure 7. Simulation results of the Base and Mental Health services scenario
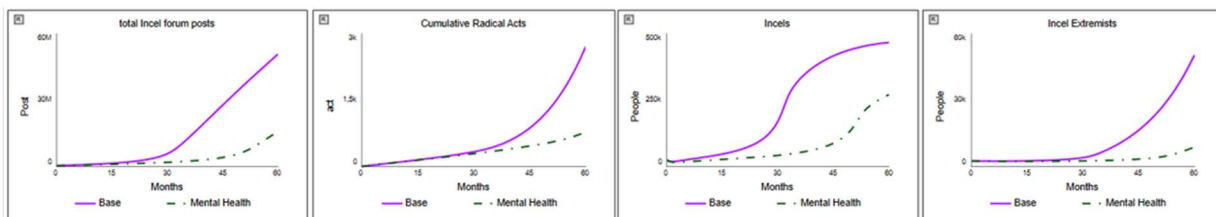
In general, the behaviour mode does not change. This time all the key performance indicators reach lowered values (the green dashed-dotted line is the simulation run). Because of the lowered "probability of mental health issues in society", there are less potential radicals, and thus a

lower probability of Interested radicalizing into Incels. This strengthens the balancing loop "Not Interested". A lower amount of Interested men radicalize into Incels, which means that there are relative more Interested individuals to lose interest in the Inceldom, and become Disinterested again. Less Incels means that there are fewer Incels forum posts, which weakens the reinforcing loop "More Incels, More posts". Less Incels also means not many Incels further extremize into Extremists, in turn leading to less radical acts.

3.5 Simulation: Deradicalization programs

For the last scenario, the effect of deradicalization programs are tested. Deradicalization programs are meant to help extremists disengage from the ideology, leave the Incel community and become disinterested. These programs can vary in their aim, like the abandonment of extreme views or resocialisation in society. They can also assist in the search for jobs, overring individuals a new life or showing non-violent courses of actions (IPI, 2010). The sensitivity analysis (seen Appendix B) indicated that the parameter "probability of de-extremization" was behavioural sensitive. This makes it an excellent leverage point for policies. In this case, the de-extremizing programs will increase the probability of Incel Extremists de-extremizing. To mimic this, the value of "probability of de-extremization" is increased to 0.1. The graphs in Figure 8 describe the behaviour of the simulation run.
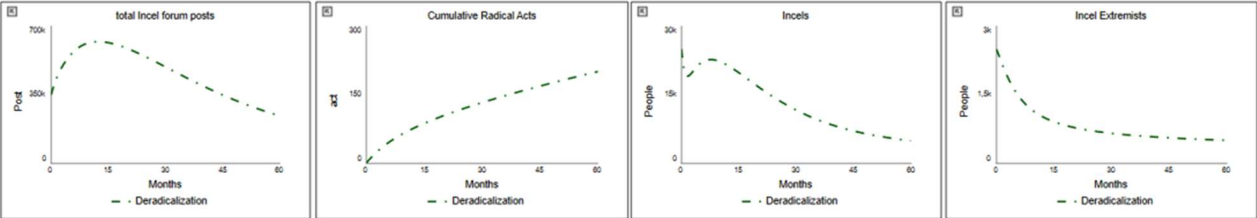

Figure 8. Simulation results from the de-extremization programs scenario

In this case, the behaviour patterns of the key performance indicators change significantly. Total Incel forums and Incels both show an initial small growth followed by a decrease. Cumulative radical acts no longer increases increasingly, but increases decreasingly. Incel Extremists decreases increasingly at first and then shifts to a decrease decreasingly. This is explained by the change in loop dominance, before the dominant loops were B1 "Not Interested" and R1 "More Incels, more posts". In this scenario, from the start the loop dominance is now B4: "Life changing", where extremists de-extremize into the "Disinterested" stock. The dominance of B4 is assisted by the reinforcing loop R8: "Burnout", this is when the amount of extreme forum posts causes extremists feelings of being burned out due to constantly being surrounded by Incel content. R8 strengthens B4. This explains the initial sharp decrease of Incel Extremists (see Figure 8). Fewer extremists cause fewer radical acts. Because the stock accumulates the Radical acts, it still increases, but it is decreasingly. After around 12 months the "Strong Women" loop becomes dominant and works on the radicalization of Incels. Figure 8 shows that the stock of Incels reaches its peak around that time. Incel Extremists reaches a tipping point where it goes from decreasing increasingly to decreasing decreasingly. Because of this initial increase in Incels "More Incels, More posts" becomes shortly dominant and slows the decrease of Incels and extremists down. However, because of the initial depletion of the stock of Extremists, there are more people in the stock of Disinterested. This strengthens the loop B1 "Not Interested". Most Incels and extremists deradicalize back to Disinterested, and men move between "Disinterested" and "Interested".

4. Discussion

The analysis of the model simulation has shown that the main driver of the radicalization process of Incels is the forum posts and Incel content. Because the Incel community is predominantly located on the Internet, this is a logical finding. The normalization of Incel values and the promotion of violence on these forums, creates an accessible radicalization and extremization environment. However, the dominance of the B1 "not Interested loop", where men came into contact with Incel content and lose interest, indicate that seeing Incel content on its own is not always enough for men to radicalize. Mirroring findings in the literature (see Regher, 2022; Moskalenko et al., 2022), the model showed how mental health issues (in this case depression) and feelings of alienation also play an important role in the radicalization process. Especially seeing how an intervention in mental health leads to a lower amount of Incels and Incel Extremists. Since COVID-19, depression and loneliness has been increasing in young adults (Berthold, 2022; CBS, 2022), making it more even more essential for authorities to invest in mental health services to prevent an Incel wave. In extension of mental health, another important literature observation (see Moskalenko et al., 2022) is the connection between Incels and the Autism spectrum. Due to the scope of this study and the delicate subject, the decision has been made to not include this in the model. Other topics which were deliberately left out, include the crossover with the broader right-wing movement and influences of Christian values. Future research could take these into consideration.

Similar to mental health services, deradicalization programs showed promising changes in the behaviour patterns of the key performance indicators. Some deradicalization programs already exists (IPI, 2010), and a few have noticed the increase in Incels (Dodd, 2023). Implementations of investments into both mental health services and deradicalization programs is feasible. However, it is up to authorities to see the merits. The short term solution of banning posts and forums is more accessible and has been done before with the banning of Incel content on Reddit (Bell, 2017). However, it should be noted that following the ban, the Incels moved to other forums which are harder to govern and thus easier to turn extreme and toxic (Baele et al., 2023). Banning of Incel posts and forums seems to be sensitive to becoming policy resistance.

5. Conclusion

This project aimed to create an explanatory model of the radicalization process of Incels. System Dynamics has helped to describe the interconnections of different explanations for radicalizing, which were found in Incel and terrorism research. The model is able to reproduce the reference mode and shows the increase in Incel Forum posts, Radical attacks, and the Incel community. This matches with what has been observed in the literature (Baele et al., 2023; Speckhard et al., 2021; Lindner, 2023). While the model is focussed on the essential feedback mechanisms, it is a good starting point for future research. The foundation for radicalization is represented and feedback loops can be added when deemed necessary.

Appendix A: Model documentation

Documentation according to the minimum model reporting requirements in Rahmandad and Sterman (2012)

STOCK:

Cumulative_Radical_Acts(t) = Cumulative_Radical_Acts(t - dt) + (committing_radical_acts) * dt

      INIT: Cumulative_Radical_Acts = Initial_Radical_Acts

      UNITS: act

DOCUMENT: This is a stock that accumulates the various committed radical acts perpetrated by Incels. The stock can increase through its inflow of "committing radical acts". Incel violence or radical acts, can be described on three levels. There is Personal violence (self-harm or suicide), Interpersonal violence (aimed at other individuals) and societal violence (mass-shootings) (RAN, 2021). The initial value is given by "Initial Radical Acts" and it is 1.

STOCK:

Disinterested(t) = Disinterested(t - dt) + (losing_interest + deradicalization + de-extremization_to_Disinterested - having_interest) * dt

      INIT: Disinterested = Initial_Disinterested-Interested-Incels-Incel_Extremists

      UNITS: People

DOCUMENT: This is a stock. It represents the male internet users in the age group of 18-34 years old. Through its outflow "having interest", people move from the stock "Disinterested" to the stock of "Interested". The Disinterested stock has two inflows, "deradicalization" and "de-extremization to Disinterested". The initial value is given by "Initial Disinterested" minus the people who are Interested, Incels and Incel Extremists.

STOCK:

Extreme_Incel_forum_posts(t) = Extreme_Incel_forum_posts(t - dt) + (generating_extreme_Incel_posts - leaving_the_extreme_collective_memory) * dt

      INIT: Extreme_Incel_forum_posts = Initial_Extreme_Forum_Posts

      UNITS: Post

DOCUMENT: This is a stock and represents the amount of Extreme Incel related posts on the various Incel forums. Total Extreme Incel forum posts increases through the inflow of "generating extreme Incel posts" and decreases through the outflow "leaving the extreme collective memory". The initial value is given by "Initial Extreme Forum Posts" and is set at 70.000

STOCK:

Incel_Extremists(t) = Incel_Extremists(t - dt) + (extremization - de-extremization_to_Disinterested - de-extremization_to_Incel) * dt

INIT: Incel_Extremists = Initial_Incel_Extremists

UNITS: People

DOCUMENT: This is a stock which represents the most active and extreme Incel members on the forums. The stock of Incel Extremists increases through its inflow "extremization" and decreases through the outflows "de-extremization to Incel" and "de-extrimization to Susceptible". The value is given by the initial value "Initial Incel Extremists".

STOCK:

Incel_forum_posts(t) = Incel_forum_posts(t - dt) + (generating_Incel_posts - leaving_the_collective_memory) * dt

INIT: Incel_forum_posts = Initial_Incel_Forum_Posts

UNITS: Post

DOCUMENT: This is a stock, it represents the total amount of posts that are being made on the various Incel forums. Total Incel forum posts increases through the inflow of "generating Incel posts" and decreases through the outflow "leaving the collective memory". The initial value is given by "Initial Forum Posts" and is set at 280.000

STOCK:

Incels(t) = Incels(t - dt) + (radicalization + de-extremization_to_Incel - extremization - deradicalization) * dt

INIT: Incels = Initial_Incels

UNITS: People

DOCUMENT: This is a stock that represents the amount of people that are active members on Incel forums, and thus are a part of the Incel community. The stock of Incels increases through the inflow of "radicalization" and decreases through the outflow of "deradicalization" and "Extremization". The inital value of Incels is given by "Initial Incels"

STOCK:

Interested(t) = Interested(t - dt) + (having_interest - losing_interest - radicalization) * dt

INIT: Interested = Initial_Interested-Incels-Incel_Extremists

UNITS: People

DOCUMENT: This is a stock that represents the amount of people that are interested in the Incel ideology. The stock increases through the inflow of "having interest" and decreases through the outflow "losing interest" and the outflow "radicalization".

The initial value is given by "Initial Interested" minus Incels and Incel Extremists.

FLOW:

committing_radical_acts = indicated_radical_acts/average_preparation_time

UNITS: act/Month

DOCUMENT: This is a flow. It is the inflow for the stock of "Cumulative Radical acts". It represents the amount of radical acts perpetrated per month. The inflow divides the indicated radical acts by the average preparation time.

FLOW:

de-extremization_to_Disinterested = Indicated_Incels_de-extremizing*(1-fraction_de-extremization_back_to_incel)

UNITS: People/Month

DOCUMENT: This is a flow. It is the outflow of the stock "Incel Extremists" and an inflow for "Disinterested". This flow displays the de-extremization process of Incels Extremists, where they go from being an Incel Extremist to Disinterested. These Incels have successfully removed themselves from the Inceldom, and move back to the Disinterested stock. It is calculated by multiplying "Indicated Incels de-extremizing" with the remaining fraction of the Incel Extremist who do not deradicalize into an Incel member.

FLOW:

de-extremization_to_Incel = Indicated_Incels_de-extremizing*fraction_de-extremization_back_to_incel

UNITS: People/Month

DOCUMENT: This is a flow. It is the outflow of the stock "Incel Extremists" and an inflow for "Incels". This flow displays the de-extremization process of Incels Extremists, where they go from being an Incel Extremist to an Incel member. It is calculated by multiplying "Indicated Incels de-extremizing" with the "fraction de-extremization back to Incel". This gives the amount of Incel Extremists per month, de-extremizing back to an Incel.

FLOW:

Deradicalization = (probability_of_deradicalization*Incels*effect_of_radical_acts_on_deradicalization)

UNITS: People/Month

DOCUMENT: This is a flow, it is the outflow for the stock of "Incels", and an inflow for the stock "Disinterested". It accounts for the Incel members that no longer want to be part of the Incel community, or no longer feel like they belong to the Inceldom, and thus become disinterested. Through "deradicalization" the stock of "Incels" decreases. It multiplies the amount of Incels in the stock with the probability of deradicalization and the effect of "committed crimes on deradicalization". This gives the amount of Incels deradicalizing per month.

FLOW:

Extremization = MIN(Incels/DT; Incels*probability_of_extremization)

UNITS: People/Month

DOCUMENT: This is a flow. It is the outflow for the stock of "Incels" and the inflow for the stock of "Incel Extremists". It moves people from Incels, through the process of extremization, to Incel Extremists. It looks at the total amount of people in the stock of "Incels" and multiplies that with the probability of people going through an extremization process and becoming an Incel Extremist. The MIN function is used to prevent the stock of Incels becoming negative, because you can not have a negative amount of people.

FLOW:

generating_extreme_Incel_posts = Incel_Extremists*average_extreme_posts_per_Incel_per_month*effect_of_radical_acts_on_Extreme_forum_posts

UNITS: Post/Months

DOCUMENT: This is a flow. It is the inflow for the stock "Extreme Incel forum posts". The inflow accounts for the change in the amount of posts per Incel per month, on the various Incel forums. To calculate the change in posts, the average extreme posts per person per month is multiplied by the amount of Incel Extremists, and multiplied with the effect Incel related radical acts has on making extreme posts.

FLOW:

generating_Incel_posts = Incels*average_Incel_posts_per_Incel_per_month*effect_of_radical_acts_on_Incel_forum_posts

UNITS: Post/Months

DOCUMENT: This is a flow. It is the inflow for the stock "Incel forum posts". The inflow accounts for the change in the amount of posts per month, on the various Incel forums. To calculate the change in posts, the average posts per Incel per month is multiplied by the amount of Incels, and multiplied with the effect Incel related radical acts has on generating posts.

FLOW:

having_interest = MIN(Disinterested/DT; Disinterested*initial_probability_of_getting_interested*Effect_of_post_prevalence_on_interest)

UNITS: People/Month

DOCUMENT: This is a flow. The flow "having interest" is the outflow of the stock "Disinterested"and the inflow for the stock of "Interested". It accounts for the amount of people that visit Incel forums or come into contact with Incel related content per month. Through the inflow the stock of "Interested" increases and the stock of "Disinterested" decreases. The flow "having interest" multiplies the "Disinterested" with the "initial probability of getting interested" and the "effect of post prevalence on interest". This would make someone become interested in the Inceldom and

moves the person to the "Interested" stock. The MIN function is used to prevent the stock of Disinterested going negative, because you cannot have a negative amount of people.

FLOW:

leaving_the_collective_memory = Incel_forum_posts/time_to_leave_the_collective_memory

UNITS: Post/Months

DOCUMENT: This is a flow, and it is the outflow of the stock "Incel forum posts". It accounts for the fact that posts are eventually forgotten. The outflow is the Incel forum posts divided by the time to leave the collective memory.

FLOW:

leaving_the_extreme_collective_memory =
Extreme_Incel_forum_posts/time_to_leave_the_collective_memory

UNITS: Post/Months

DOCUMENT: This is a flow, it is the outflow of the stock "Extreme Incel form posts". It accounts for the fact that posts are eventually forgotten. The outflow is the Extreme Incel forum posts divided by the time to leave the collective memory.

FLOW:

losing_interest = Interested*probability_of_losing_interest

UNITS: People/Month

DOCUMENT: This is a flow. The flow "losing interest" is the rate at which people are no longer interested in the Incel ideology or community. It is the outflow of the stock "Interested" and the inflow for the stock "Disinterested". Through the outflow, the stock of "Interested" decreases and the stock of "Disinterested" increases. The flow "losing interest" looks at the amount of interested people and multiplies it by the probability of people losing interest in the Inceldom. This gives the amount of Interested people per month losing interest and becoming Disinterested.

FLOW:

Radicalization = MIN(Interested/DT; Potential_radicals*probability_of_radicalization)

UNITS: People/Month

DOCUMENT: This is an flow, it is the outflow of the stock of "Interested" and the inflow of the stock "Incels". It moves people who are interested in the Incel ideology and community, through a radicalization process, to being an active member of the Incel community. It multiplies the "potential radicals" with the "probability of radicalization". This gives the amount of interested people radicalizing into an Incel per month. The MIN function is used to prevent the Interested stock going into the negative, because you cannot have a negative amount of people.

adjustment_time = 12

    UNITS: Month

DOCUMENT: This is a parameter that accounts for the adjustment time that is needed for Interested people to become angry by increase in Feminism. The adjustment time is assumed to be 12 months, because it takes time before an increase in Feminism in society is noticed.

Alienation = Density_of_Incel_Community/Threshold_for_alienation

    UNITS: Dimensionless

DOCUMENT: This variable accounts for the alienation of the Incel community. In this case, alienation represents being persecuted for being a member of the Incel community, and becoming more lonely and/ or depressed as a direct consequence of being an Incel member. It is the density of the Incel community divided by the "threshold for alienation".

---

average_extreme_posts_per_Incel_per_month = 8

    UNITS: Post/People/Month

DOCUMENT: This is a parameter. It is the average amount of posts made per Incel extremist on Incel forums. Baele et al. (2023) analysed a total of 1,717,516 posts made over a time period of nearly nine years. The value of 16.000 posts per months is this total amount of posts divided by the 9 year time period. This is then multiplied by 0.2 (20%) to account for the most extreme posts being made on Incel forums. Lastly, this is divided by 406, which represents the "power-users" among Incel extremists (CDHH, 2022). This gives a value of around 8.

---

average_Incel_posts_per_Incel_per_month = 3

    UNITS: Post/People/Month

DOCUMENT: This is a parameter. It is the average amount of posts made on Incel forums. Baele et al. (2023) analyzed a total of 1,717,516 posts made over a time period of nearly nine years. The value of 16.000 posts per month is this total amount of posts divided by the 9 year time period. This is then multiplied by 0.8 (80%) to account for the less extreme posts being made on Incel forums. Lastly, this is then divided by 4000, which represents active Incel members (CDHH, 2022). This gives a value of around 3

---

average_preparation_time = 10

    UNITS: month

DOCUMENT: This is a parameter that looks at the average time an Incel Extremist need to prepare the violent attack. In order to get the value I calculated the average of 5 well-known Incel attacks. Alek Minassian needed 1 month of preparation time (Herhalt, 2019). Chris Harper-Mercer also needed 1 month to prepare (Young, 2016). Elliot Rodger needed around 14 months to prepare (Duke, 2014). Nikolas Cruz spent years reading about mass killings, but spiraled after a breakup 6 months before the attack (Spencer, 2022). Scott Beierle started preparing his violent attack more than 2 years in advantage (Burlew & Etters, 2019). On average this is a time of 10 months.

average_radical_acts_per_extremist = 4

       UNITS: act/people

DOCUMENT: This is a parameter, it is the average radical act per extremist. Radical acts can be found on three levels; Personal violence, Interpersonal violence and Societal violence. Research on lone wolfs, comparable to Incel related violent atatcks, shows that 40% have committed multiple violent or radical acts (Hamm & Spaaj, 2015). Elliot Rodger committed 7 different radical acts (Duke, 2014). Alek Minassian and Chris Harper-Mercer both committed only 1 radical act (Herhalt, 2019; Young, 2016). While Nikolas Cruz committed at least 4 different radical acts (de Haldevang, 2018), and Scott Beierle committed 5 (Burlew & Etters, 2019). Taking the average of this it would be 18 radical acts divided by 5 rounded up to 4

Density_of_Incel_Community = Total_Incel_Community/Total_Population

       UNITS: Dimensionless

DOCUMENT: This variable represents the density of the Incel community. It compares the total Incel community to the total population used in this model. Dividing the total Incel community with the total population will give the density of the Incel community.

Effect_alienation_on_the_probability_of_extremization = GRAPH(Alienation) Points: (0,000, 0,010), (0,0833333333333, 0,010525), (0,166666666667, 0,0269684782609), (0,250, 0,0522011857708), (0,333333333333, 0,0895420948617), (0,416666666667, 0,142243181818), (0,500, 0,212945719784), (0,583333333333, 0,303209357881), (0,666666666667, 0,413180771098), (0,750, 0,541438434299), (0,833333333333, 0,685024112558), (0,916666666667, 0,839649978687), (1,000, 1,000), (1,08333333333, 1,16045416218), (1,16666666667, 1,31507475276), (1,250, 1,4586505886), (1,33333333333, 1,58689353068), (1,41666666667, 1,6968469593), (1,500, 1,78709387352), (1,58333333333, 1,85778820817), (1,66666666667, 1,91049736495), (1,750, 1,94786561265), (1,83333333333, 1,97313405797), (1,91666666667, 1,98958333333), (2,000, 2,000)
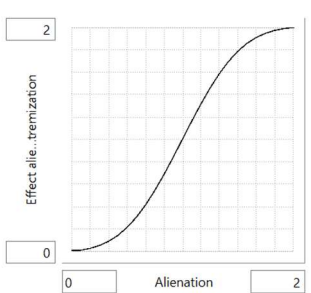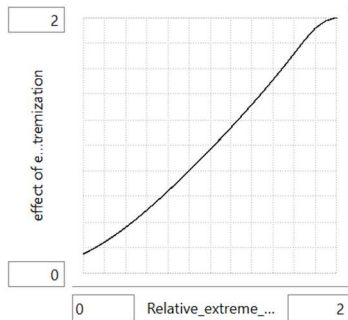

       UNITS: Dimensionless

DOCUMENT: This is a table function. It represents the effect feelings of alienation has on the probability of extremization. At the 1:1 point, when feelings of alienation are as they are, there is no added effect on the probability of extremization. When feelings of alienation increase, there will be an increase on the probability of extremization. Eventually, when feelings of alienated increase a lot, it will become normal and it wil no longer have an added effect on the probability of extremization. That is why the table function has an S-shape. At the maximum, the effect of alienation will double the probability of extremization.

effect_Feminist_reaction_on_angry_boys =
SMTH1(effect_of_media_exposure_on_Feminist_activism; adjustment_time)

UNITS: Dimensionless

DOCUMENT: Incels are anti-feminist (Lindner, 2023). Seeing and consuming anti-feminist views is part of the radicalization process of Incels (Regher, 2022). However, people will not immediately notice an increase in Feminism in society. There is a delayed reaction before there is an effect of the feminist reaction on the probability of Interested people radicalizing into Incels. If Feminist activism increases, so does the effect on the probability of radicalization.

---

effect_of_extreme_forum_posts_on_de-extremization = GRAPH(Relative_extreme_forum_posts)
Points: (0,000, 0,149), (0,0833333333333, 0,192111669394), (0,166666666667, 0,241102606046), (0,250, 0,2958606022), (0,333333333333, 0,3559996571), (0,416666666667, 0,420978440858), (0,500, 0,490183586022), (0,583333333333, 0,562991815382), (0,666666666667, 0,638819571478), (0,750, 0,717164378473), (0,833333333333, 0,797638588555), (0,916666666667, 0,879993400819), (1,000, 0,964129058406), (1,08333333333, 1,05008590692), (1,16666666667, 1,13801052106), (1,250, 1,22809137388), (1,33333333333, 1,3204777382), (1,41666666667, 1,41526593593), (1,500, 1,5127023014), (1,58333333333, 1,61351411801), (1,66666666667, 1,71834324327), (1,750, 1,82413450056), (1,83333333333, 1,91729210049), (1,91666666667, 1,97451311464), (2,000, 2,000)
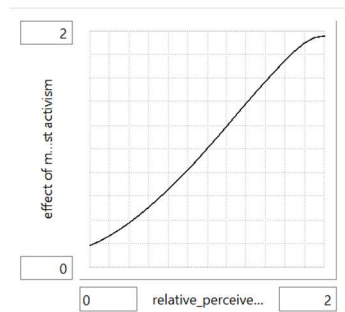

UNITS: Dimensionless

DOCUMENT: This is a table function. It looks at the effect of extreme forum posts on the de-extremization process of Incels. Deradicalization or de-extremizing is not a linear process. It might mean that individuals completely leave the ideology, or it might mean a shift in the position and violent behaviour of individuals. Where violence is no longer accepted, but the main beliefs and values of the ideology are still a prominent part of an individual (Barelle, 2015; START, 2019). De-extremization can happen after feelings of burnout, when extremist have been around certain beliefs for too long (Horgan et al., 2017). At first a small increase of relative extreme posts will not matter, until it starts increasing and becomes more than 1, then it will have an effect on the de-extremization process. Up until there are so many more extreme forum posts, that extremist get desensitized and the effect is less strong. This is why the table function has an S-shape.

Effect_of_extreme_posts_on_extremization = MIN(maximum_effect_on_extremization; 1 + Sensitivity_of_extreme_posts_on_extremization*(Relative_extreme_forum_posts-1))

UNITS: Dimensionless

DOCUMENT: This variable is the effect Extreme posts have on the probability of extremization. It uses a MIN function, so that it will always take the smaller effect. This will either be the maximum effect on extremization or the effect of extreme posts on extremization.

---

effect_of_media_exposure_on_Feminist_activism =
GRAPH(relative_perceived_mass_media_on_Incel_related_acts) Points: (0,000, 0,182), (0,0833333333333, 0,219076173132), (0,166666666667, 0,263332529631), (0,250, 0,314258516744), (0,333333333333, 0,371521740849), (0,416666666667, 0,434727075671), (0,500, 0,503286890119), (0,583333333333, 0,57646486195), (0,666666666667, 0,653564916929), (0,750, 0,734149155776), (0,833333333333, 0,818138005867), (0,916666666667, 0,905696806776), (1,000, 1,000), (1,08333333333, 1,09149556734), (1,16666666667, 1,18842450775), (1,250, 1,28618032317), (1,33333333333, 1,38310999556), (1,41666666667, 1,47801100301), (1,500, 1,5704601487), (1,58333333333, 1,66048803912), (1,66666666667, 1,74741564044), (1,750, 1,82818218685), (1,83333333333, 1,8961412413), (1,91666666667, 1,94165163089), (2,000, 1,955)

UNITS: Dimensionless

DOCUMENT: This is a table function. More mass media exposure means that Incel related acts come to light, and there will be a reaction from feminists continuing to fight for equal rights. This is seen after Elliot Rodger's attack, when women banded together and shared their stories online (Blake, 2015). Or when a Canadian minister called out society to talk about misogyny after the Alek Minassian attack (CBC News, 2018). When mass media exposure increases too much the Incel attacks will be seen as the new normal and people will get desensitized. The effect of media exposure on Feminist activism will lessen near the max, which is why it is S-shaped. At the maximum the effect will double.

---

effect_of_media_vilification_on_extremization =
GRAPH(relative_perceived_mass_media_on_Incel_related_acts) Points: (0,000, 0,230), (0,0833333333333, 0,27418609577), (0,166666666667, 0,324236823114), (0,250, 0,379332171667), (0,333333333333, 0,438706417442), (0,416666666667, 0,501662394312), (0,500, 0,567580151678), (0,583333333333, 0,635927947794), (0,666666666667, 0,706278767604), (0,750, 0,778330478926), (0,833333333333, 0,851923908065), (0,916666666667, 0,927051213481), (1,000, 1,000), (1,08333333333, 1,08255600544), (1,16666666667, 1,16347401532), (1,250, 1,2468598824), (1,33333333333, 1,33281937293), (1,41666666667, 1,42116098107), (1,500, 1,51122391482), (1,58333333333, 1,60167780448), (1,66666666667, 1,69029495014), (1,750, 1,77370182919), (1,83333333333, 1,8471313682), (1,91666666667, 1,90422687828), (2,000, 1,937)
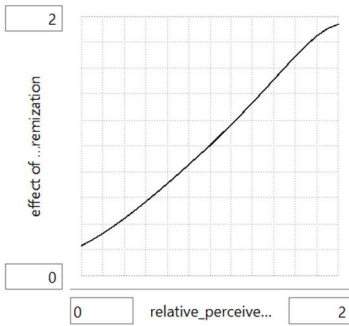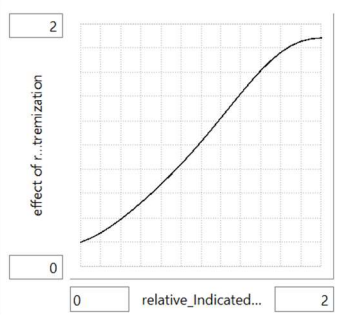
UNITS: Dimensionless

DOCUMENT: This is a table function, it looks at the effect that media vilification has on the probability of extremization. Media vilification is based on the media exposure on Incel related radical acts. Tomkinson et al. (2020) notes that mass media reporting on Incels can lead to feelings of persecution which in turns can cause encouragement of engagement in violence. Furthermore, Lounela and Murphy (2023) argue that the portrayal of "all Incels are violent extremists", which is often used by the media, can create harmful and dangerous stereotypes. Inciting further feelings of persecution among the Incel community. When media vilification increases, the effect on the probability of extremization will also increase until the increased media vilification will become normal and make Incels less sensitive to the message. This is why the shape of the table graph is a positive S-shape. At the maximum of perceived media villification, the effect will double the probability of extremization.

Effect_of_post_prevalence_on_interest = MIN(Maximum_effect_on_interest; 1 + Sensitivity_of_posts_on_interest*(Relative_Incel_posts-1))

UNITS: Dimensionless

DOCUMENT: This variable represents the effect of post prevalence on becoming interested in Incel content. It uses a MIN function, so that it will always take the smaller effect. The variable will either take the effect of the relative Incel posts or the maximum effect on interest.

effect_of_radical_acts_on_de-extremization = GRAPH(relative_Indicated_radical_acts) Points: (0,000, 0,199), (0,0833333333333, 0,230795335032), (0,166666666667, 0,274011249174), (0,250, 0,326452848151), (0,333333333333, 0,386053596115), (0,416666666667, 0,451163687805), (0,500, 0,520681337774), (0,583333333333, 0,594051114402), (0,666666666667, 0,67116515094), (0,750, 0,752204382599), (0,833333333333, 0,837452324416), (0,916666666667, 0,927106711977), (1,000, 1,02110702088), (1,08333333333, 1,11899005387), (1,16666666667, 1,21978227331), (1,250, 1,32193653819), (1,33333333333, 1,42332198996), (1,41666666667, 1,52127816634), (1,500, 1,61274677539), (1,58333333333, 1,69449543121), (1,66666666667, 1,76344535027), (1,750, 1,81710776396), (1,83333333333, 1,85411985934), (1,91666666667, 1,87484876464), (2,000, 1,882)

UNITS: Dimensionless

DOCUMENT: This is a table function. It looks at the effect of relative indicated radical acts on de-extremization. At the 1:1 point, when indicated radical acts is the same as relative indicated acts, there is no added effect on the probability on de-extremization. Deradicalization or de-extremizing is not a linear process. It might mean that individuals completely leave the ideology, or it might mean a shift in the position and violent behaviour of individuals. Where violence is no longer accepted, but the main beliefs and values of the ideology are still a prominent part of an individual (Barelle, 2015; START, 2019). A cause for de-extremization is disillusionment with the cause or ideology (Horgan et al., 2017). With an increase in relative indicated radical acts, extremists might no longer agree with the tactics or outcomes and start de-extremizing. However, the more radical acts, the more normal it becomes, which is why the effect will then lessen. This is why the table function is S-shaped.

---

effect_of_radical_acts_on_deradicalization = GRAPH(relative_Indicated_radical_acts) Points: (0,000, 0,191), (0,0833333333333, 0,223565266446), (0,166666666667, 0,265720858713), (0,250, 0,316489666463), (0,333333333333, 0,374712619569), (0,416666666667, 0,439169872317), (0,500, 0,508677369957), (0,583333333333, 0,582195459173), (0,666666666667, 0,658987621552), (0,750, 0,738536386849), (0,833333333333, 0,820068617158), (0,916666666667, 0,902181623438), (1,000, 1,000), (1,08333333333, 1,060506449), (1,16666666667, 1,13278989194), (1,250, 1,19780852149), (1,33333333333, 1,25371245416), (1,41666666667, 1,29968457093), (1,500, 1,33652802859), (1,58333333333, 1,36582912478), (1,66666666667, 1,38806974343), (1,750, 1,40209273752), (1,83333333333, 1,40754256172), (1,91666666667, 1,40706594673), (2,000, 1,400)
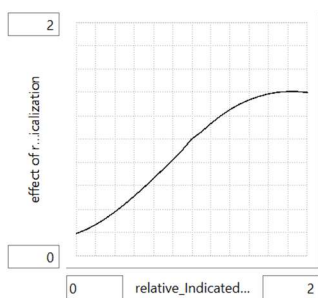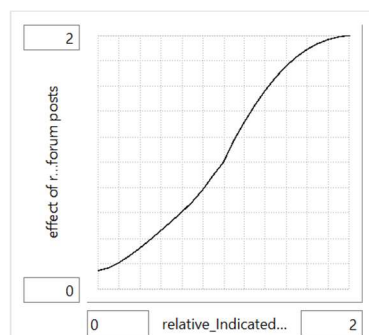

UNITS: Dimensionless

DOCUMENT: This is a table function. It looks at the effect relative indicated radical acts has on deradicalization. A small percentage of the Incel community has expressed negative views on violence and indications of violence (O'Donnell & Shor, 2022). When the indicated radical acts increase, this will have an effect on that small part of the Incel community. However, majority of Incels say to be non-violent, however research has shown that even for those who say to be non-violent, some still agree with violent and misogynistic statements (Speckhard et al., 2021).

Furthermore, an increase in indicated radical acts will eventually become normal and will have a lesser effect on the deradicalization of Incels. For the minimum (no indicated radical acts) there will still be Incels deradicalizing because they no longer adhere to the ideology. This is why the table function is S-shaped.

effect_of_radical_acts_on_Extreme_forum_posts = GRAPH(relative_Indicated_radical_acts) Points: (0,000, 0,145), (0,0833333333333, 0,16717009644), (0,166666666667, 0,207997627863), (0,250, 0,260930376038), (0,333333333333, 0,322564925943), (0,416666666667, 0,389902597568), (0,500, 0,460440642049), (0,583333333333, 0,532302003776), (0,666666666667, 0,605883446537), (0,750, 0,685991487905), (0,833333333333, 0,780565576776), (0,916666666667, 0,895471736302), (1,000, 1,000), (1,08333333333, 1,17379636505), (1,16666666667, 1,31677263335), (1,250, 1,44938962826), (1,33333333333, 1,56762442943), (1,41666666667, 1,67080843996), (1,500, 1,75904258825), (1,58333333333, 1,83231303768), (1,66666666667, 1,89088643968), (1,750, 1,9354701061), (1,83333333333, 1,96725912523), (1,91666666667, 1,98800472522), (2,000, 2,000)

UNITS: Dimensionless

DOCUMENT: This is a table function, it shows the effect that Radical Incel related acts has on Extreme Incel forum posts. After Incel related radical acts, Baele et al. (2023) have noticed an increase in forum posts and over time in Violent extremist language. Baele et al. (2023) saw that violent extreme language increased even when there were no new radical acts. For the minimum (no radical acts) there will, thus, still be an effect on Extreme forum posts. The maximum (double the amount of radical acts) is set at 2. Baele et al. (2023) also saw in their analysis that not all radical acts had the same effect on increases. An increase in radical attacks will initially increase the generating of forum posts. At one point, more radical acts will become normal and less topic of conversation. So that is why the shape of the graph is S-shaped.

effect_of_radical_acts_on_Incel_forum_posts = GRAPH(relative_Indicated_radical_acts) Points: (0,000, 0,172), (0,0833333333333, 0,181625053027), (0,166666666667, 0,207108964424), (0,250, 0,248150529752), (0,333333333333, 0,302946112642), (0,416666666667, 0,369466445143), (0,500, 0,446087166685), (0,583333333333, 0,531104528358), (0,666666666667, 0,622814322892), (0,750, 0,720302768387), (0,833333333333, 0,823989945657), (0,916666666667, 0,905), (1,000, 1,000), (1,08333333333, 1,18084143834), (1,16666666667, 1,31050306559), (1,250, 1,43822700757), (1,33333333333, 1,55876327896), (1,41666666667, 1,66824016033), (1,500, 1,76440426497), (1,58333333333, 1,84574604584), (1,66666666667, 1,91053879258), (1,750, 1,95706672687), (1,83333333333, 1,98516487507), (1,91666666667, 1,99742265671), (2,000, 2,000)
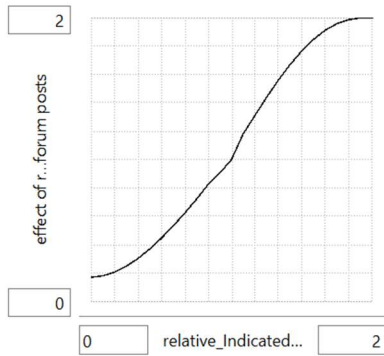
UNITS: Dimensionless

DOCUMENT: This is a table function, it shows the effect that Radical Incel related acts have on Incel forum posts. Baele et al. (2023) has notices an increase in Incel forum posts over the years. When Incel related radical acts happened, the amount of posts increased. Both to debate the position of Incels within society and to discuss the effectiveness of violence. But it has also been noticed that not all radical acts have the same effect on the generation of posts (Baele et al., 2023). If there are too many radical acts, it becomes so normal that it no longer generates the same increase in posts. Therefore, the effect of radical acts on Incel forum posts is a positive S-shape. For the minimum (no radical acts) there will always be some posts discussing what radical acts would do for the Inceldom. For the maximum (double the radical acts), an increase in radical attacks will initially increase the generating of forum posts. At one point, more radical acts will become normal and less topic of conversation.

effect_of_radical_acts_on_social_media_glorification = GRAPH(relative_Indicated_radical_acts)
Points: (0,000, 0,181), (0,0833333333333, 0,178694680093), (0,166666666667, 0,191680843826), (0,250, 0,223690654309), (0,333333333333, 0,274584626956), (0,416666666667, 0,341772599849), (0,500, 0,421592004555), (0,583333333333, 0,510213688407), (0,666666666667, 0,604142645576), (0,750, 0,700480748123), (0,833333333333, 0,79707354176), (0,916666666667, 0,892591740046), (1,000, 0,986545995178), (1,08333333333, 1,07921145523), (1,16666666667, 1,17144225353), (1,250, 1,26437553935), (1,33333333333, 1,35904799255), (1,41666666667, 1,45596286106), (1,500, 1,55464373329), (1,58333333333, 1,65319471285), (1,66666666667, 1,74788112506), (1,750, 1,83281768265), (1,83333333333, 1,90013396348), (1,91666666667, 1,94170231908), (2,000, 1,955)
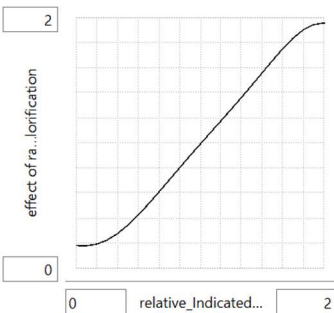
UNITS: Dimensionless

DOCUMENT: This is a table function. It shows the effect radical Incel related acts has on social media glorification. Social media provides a platform for misogyny to reach individuals who will turn it into

physical violence. Social media has made it possible to form a community for likeminded people to find each other and share their Incel ideologies. Incels are constantly surround by people who share the same beliefs and glorify violence. The algorithms recommend content to users, and presents viewers with so called "echo chambers". This makes it seem as if extremist views are no longer taboo and are shared by many. Violence and Incel beliefs are being normalized online and even seen as desirable. Social media then plays a big part in the radicalization process (Coopey, 2022). The table function has an S-shape. The more content you see, the more effect there is. Until you see too much content and it becomes so normal that you get desensitized.

---

fraction_de-extremization_back_to_incel = 0,49

      UNITS: Dimensionless

DOCUMENT: This is a parameter, it accounts for the probability of Incels going through the de-extremization process. Start (2019) found that during the deradicalization process 49% of extremists would go back to their extremist groups or ideologies. Deradicalization is not a straight-forward process and probability of extremists ending back in their ideology is high. The value here is set at 49% or 0.49.

Indicated_Incels_de-extremizing = Incel_Extremists*probability_of_de-extremization*effect_of_radical_acts_on_de-extremization*effect_of_extreme_forum_posts_on_de-extremization

      UNITS: People/month

DOCUMENT: This is a variable that looks at Incels that could de-extremize back into either an Incel or a Disinterested. To get the Indicated Incels, Incel Extremists is multiplied with the probability of de-extremization, the effect of extreme forum posts and the effect of radical acts. All this together gives the amount of people per month ready to de-extremize

---

indicated_radical_acts = Incel_Extremists*average_radical_acts_per_extremist*probability_of_extremists_committing_radical_acts

      UNITS: act

DOCUMENT: This variable determines the maximum amount of Incel Extremists that will actually commit a violent act. It multiplies the Incel extremists with the probability of extremists committing radical acts and the average radical acts per extremist.

Initial_Disinterested = 1,4 Billion

      UNITS: People

DOCUMENT: This is a parameter. It is the initial value of the stock "Disiterested ". It represents the total amount of the male internet users in the age group of 18-34 years old. The total amount of internet users is around 4 billion (Kemp, 2021). For the men between ages 18-34 (Statista,n.d.) this accounts for 1.4 billion

Initial_Extreme_Forum_Posts = 70000

    UNITS: Post

DOCUMENT: This is the initial value of the stock "Extreme Incel forum posts". The amount of posts/comments on the original Incel Reddit after one year is used for representation. Before the original Incel Reddit got banned, it was roughly 4 years active, with more than 1.4 million comments and posts. 1.4 million / 4 = 350000 after 1 year (Helm et al., 2022). More than a fifth of all the posts containing either misogynist, racist, antisemitic or anti-LGBTQ+ language (CCDH, 2022). 20% of 350000 is 70.000, this is the initial value of the stock "Extreme Incel forum posts".

Initial_Incel_Extremists = 2500

    UNITS: People

DOCUMENT: This is the initial value of the stock "Incel Extremists". According to Lindner (2023) there is a small subset of Incel members, around the 10%, who are the most active and responsible for the most hateful comments. 10% of the initial value of "Incels" is 2500.

Initial_Incel_Forum_Posts = 280000

    UNITS: Post

DOCUMENT: This is the initial value of the stock "Incel forum posts". The amount of posts/comments on the original Incel Reddit after 1 year is used. Before the original Incel Reddit got banned, it was roughly 4 years active, with more than 1.4 million comments and posts. 1.4 million / 4 = 350000 after 1 year (Helm et al., 2022). More than a fifth of all the posts containing either misogynist, racist, antisemitic or anti-LGBTQ+ language (CCDH, 2022). These are the remaining 4/5 of the posts. 80% of 350000 is 280.000, this is the initial value for the stock "Incel forum posts"

Initial_Incels = 25000

    UNITS: People

DOCUMENT: This is the initial value of the amount of Incel members. It is the total amount of members of the three biggest Incel forums. The value is set at 25000 (Pelzer et al., 2020).

Initial_Interested = 7,6 Million

    UNITS: People

DOCUMENT: This is the initial value of the amount of people interested in the Incel ideology. The initial value is set at 7.6 million people who visit the various forums (CCDH, 2022).

Initial_probability_of_extremization = 0,002

    UNITS: Dimensionless/month

DOCUMENT: This is a parameter, it accounts for the probability of an "Incel" further radicalizing into an "Incel Extremist". The value is found by looking at the database of the Study of Terrorism and Responses to Terrorism (START, 2019). Over a 10 year period, between 2010 and 2020, there were

895 violent extremist in the United States. Of those 895 violent extremists, 162 were radicalized through the internet. This is similar to the radicalization process of Incels and Incel Extremists. 162 divided by 895 gives a value of 0,181. This is then divided by 10 years = 0,0181. And lastly, 0,0181 is divided by 12 months to get the initial probability of extremization per month. This is around 0,002.

initial_probability_of_getting_interested = 0,022

UNITS: Dimensionless/month

DOCUMENT: This is a parameter that represents the initial probability of getting interested in the Inceldom. The value is set at 0,022. This is based on an analysis that that indicates that there is a 5.5 times increase in web traffic data on the 3 largest Incel sites over a period of 8 months (Lough, 2022). To get the initial probability of getting interested, the initial value is calibrated to match the 5.5x increase of people becoming interested over 8 months, without the effect function. This gave the value of 0,022.

Initial_probability_of_radicalization = 0,001

UNITS: Dimensionless/month

DOCUMENT: 99% of the people with radical thoughts will never act upon them (McCauley & Moskalenko, 2017) This parameter accounts for the 1% who does act upon their radical thoughts and go through the radicalization process. The 1% is adjusted for the fact that it is the probability of radicalization is given per month.

Initial_Radical_Acts = 1

UNITS: act

DOCUMENT: This is the initial value of the stock "Cumulative Radical Acts". The initial value is set to 1. This is the violent attack of Marc Lepine in 1989, which is often seen as the first or original Incel attack (Bloom, 2022).

mass_media_exposure_multiplier = 1,5

UNITS: Dimensionless

DOCUMENT: This is a constant. It is the how much the Mass Media normally spends on covering crime. On average, 50% of news coverage is devoted to crime stories (Mann, 2018). There is more crime coverage than that there are actual crimes committed. Not only is on average 50% of the media coverage devoted to crimes stories, they were about violent crimes which only makes up 7% of all crimes (John Howard Society, 2019).

mass_media_Incel_related_acts_exposure = committing_radical_acts*mass_media_exposure_multiplier

UNITS: act/Month

DOCUMENT: This variable is the exposure of Incel related radical acts by the mass media. It follows the assumption that with more radical acts, there will be more mass media exposure. This

assumption is based on the role the mass media has in society. It is there to inform and raise awareness on current events (Bhatt, 2020). Furthermore, radical acts and crime is over represented in the media. It gets a lot of media time compared to how often these crimes or radical acts are actually committed (John Howard Society, 2019). The value of Mass media Incel related acts exposure is "committing radical acts" multiplied by "mass media exposure multiplier".

maximum_effect_on_extremization = 10

　　　UNITS: Dimensionless

DOCUMENT: This is the maximum effect Extreme Incel forum posts can have on the extremization process of an Incel to an Incel Extremist. The value is set at 10, to prevent the initial probability of extremization from increasing to a very high number.

Maximum_effect_on_interest = 10

　　　UNITS: Dimensionless

DOCUMENT: This parameter represents the maximum effect there can be on interest in Incel related content. The value is set at 10, to account for the effect an increase in Incel posts will have on Interest but to also prevent the initial probability of getting interested from increasing to a very high number.

media_adjustment_time = 3

　　　UNITS: Month

DOCUMENT: Media adjustment time is the time the media needs to see Incel related radical acts as a threat. Media coverage often downplays misogynistic violence as isolated attacks perpetrated by either crazed lone-wolfs or people who are struggling with mental health issues. The media might also sympathize with the cause. This downplays the seriousness and the accountability of the perpetrator. It also ignores the rising threat of these kind of attacks and the misogyny at heart (Fugardi, 2023). The assumption is that the Media needs 3 months.

perceived_mass_media_on_Incel_related_acts = SMTH1(mass_media_Incel_related_acts_exposure; media_adjustment_time)

　　　UNITS: act/Month

DOCUMENT: This variable accounts for the fact that the mass media might need time to adjust their view on Incel related acts. Especially, when accounting for the tendency of the mass media to portray young white men as mentally ill and victims of the system (Duxbury et al., 2018).

Potential_radicals = Interested*susceptibility_to_radicalization

　　　UNITS: People

DOCUMENT: This variable represents the people who have the potential to radicalize and become Incels. Potential radicals is the people in the Interested stock multiplied by the "susceptibility to radicalization".

probability_of_being_bullied_in_society = 0,17

> UNITS: Dimensionless

DOCUMENT: This is a parameter. It is the percentage of men in society who were bullied at school. According to the National Center for Education (2019), 17% of young men report being bullied in school. This is the value that will be used, 17% or 0,17.

---

probability_of_de-extremization = 0,01

> UNITS: Dimensionless/month

DOCUMENT: This is a parameter, and accounts for the probability of an Incel de-extremizing. Only a very small group of people will ever go through the process of becoming a radical and eventually further radicalizing in to an extremist (McCauley & Moskalenko, 2017). Deradicalization or de-extremization is not an easy process and can take years (START, 2019). An example of a way to deradicalize is through a program like PREVENT in the United Kingdom. While, PREVENT, has noticed an increase in people being directed towards their deradicalization programs, only a very small percentage will qualify, and an even smaller percentage is actually open to partaking in the program (Weeks, 2021). Another option is self-deradicalization. Posts on Reddit made by old Incels (AskReddit, n.d), show that it is not easy to get out of the ideology and that it takes months to years to let go of beliefs and views. Even some who have said to no longer be an Incel mention or write messages with beliefs to be closely related to the views of the Inceldom. Because of this, the probability of de-extremization (per month) is assumed to be 1% or 0.01

---

probability_of_deradicalization = 0,5

> UNITS: Dimensionless/month

DOCUMENT: This is a parameter, and accounts for the probability of an Incel deradicalizing. This means that an Incel detaches from the Incel ideology, to become a Susceptible again. The value is determined by the findings of Pelzer et al. (2021). Were it was noticed that approximately half of the members only stayed active for up to one month. The value of probability of deradicalization is therefor set at 50% or 0,5

---

probability_of_extremists_committing_radical_acts = 0,01

> UNITS: Dimensionless

DOCUMENT: This is a parameter, which accounts for the probability of Violent Extremists who will actually engage in radical acts. Wolfowicz et al. (2020) explain this as less than 1% will actually "take up arms" and commit violence in the name of their ideology. This accounts for the Interpersonal violence and Societal violence, as explained by RAN (2021). Personal violence, suicide or self-harm, is a common topic of discussion for Incels. Young men are at a high-risk for committing suicide (Daly & Laskvtsov, 2021). And while suicide rates have increased over the years, it is less than 1% that will actually commit suicide (AFSP, 2021). Thus, the value is set at 1% or 0,01

---

probability_of_extremization = Initial_probability_of_extremization*
(effect_of_media_vilification_on_extremization*weight_media_vilification +

Effect_alienation_on_the_probability_of_extremization*weight_alienation +
Effect_of_extreme_posts_on_extremization*weight_Extreme_forum_posts)

UNITS: Dimensionless/month

DOCUMENT: This is a variable that accounts for the probability of extremization. The probability of extremization is calculated by the initial probability of extremization multiplied by the sum of the effects of media vilification, extreme forum posts and alienation. To get the sum of the effects, the three effects are multiplied by their respective weights and then added together.

---

probability_of_loneliness_in_society = 0,5

UNITS: Dimensionless

DOCUMENT: This is a parameter. It is the percentage of people feeling lonely in society. In the United States, about half of the adults reported experiencing feelings of loneliness (Summers et al., 2023). This is the value that will be used, 50% or 0.5

---

probability_of_losing_interest = 0,83

UNITS: Dimensionless/month

DOCUMENT: This parameter accounts for the probability of losing interest per month. Pelzer et al. (2021) analyzed three prominent Incel forums. Based on their research of forum activity, the probability of losing interest is set at 83% per month, or 0.83

---

probability_of_mental_health_issues_in_society = 0,284

UNITS: Dimensionless

DOCUMENT: This is a parameter. It is the percentage of men with self-reported mental health in society. In this case, the focus will be solely on depression. The choice of using self-diagnosed depression instead of diagnosed depression is made because of the assumption that people who self-diagnosed will spent more time on the internet trying to understand what they have, and try to find people in similar situations. The percentage of men with self-reported depression is 28.4% (Moskalenko et al., 2022). This is the value that will be used, 28.4% or 0.284

---

probability_of_radicalization =
Initial_probability_of_radicalization*effect_Feminist_reaction_on_angry_boys*effect_of_radical_acts_on_social_media_glorification

UNITS: Dimensionless/month

DOCUMENT: This is a variable that accounts for the probability of an "Interested" person radicalizing into an "Incel". The value is determined by the "initial probability of radicalization" multiplied with the effect of the feminist reaction and the effect of social media glorification.

Relative_extreme_forum_posts = Extreme_Incel_forum_posts//INIT(Extreme_Incel_forum_posts)

UNITS: Dimensionless

DOCUMENT: This is a variable that looks at the ratio of the amount of Extreme Incels forum posts, compared to the initial amount of Extreme Incels forum posts. When the ratio is 1, then the amount of Extreme Incel forum posts is the same as the initial amount of Extreme Incel forum posts. When the ratio is less than 1, the Extreme forum posts have decreased. When the ratio is more than 1, the Extreme forum posts have increased.

Relative_Incel_posts = total_Incel_forum_posts//INIT(total_Incel_forum_posts)

UNITS: Dimensionless

DOCUMENT: This is a variable that looks at the ratio of the total Incel forum posts, compared to the initial amount of total Incel forum posts. When the ratio is 1, the total Incel forum posts are the same as the initial. When the ratio is less than 1, the total Incel forum posts have decreased. When the ratio is more than 1, the total amount of Incel forum posts have increased compared to the initial amount

---

relative_Indicated_radical_acts = indicated_radical_acts//INIT(indicated_radical_acts)

UNITS: Dimensionless

DOCUMENT: This is a variable that looks at the ratio of the indicated radical acts, compared to the initial indicated radical acts. When the ratio is 1, the indicated radical acts are the same as the initial. When the ratio is less than 1, the indicated radical acts have decreased. When the ratio is more than 1, the indicated radical acts have increased compared to the initial indicated radical acts.

---

relative_perceived_mass_media_on_Incel_related_acts = perceived_mass_media_on_Incel_related_acts//INIT(perceived_mass_media_on_Incel_related_acts)

UNITS: Dimensionless

DOCUMENT: This variable accounts for the relative perceived mass media on Incel related acts. It looks at the ratio of perceived mass media, compared to the initial value of perceived mass media. When the ratio is 1, then the perceived mass media on Incel related acts is the same as the initial amount. When the ratio is less than 1, the perceived mass media has decreased. When the ratio is more than 1, the perceived mass media has increased compared to the initial.

---

relative_weight_being_bullied = 0,5

UNITS: Dimensionless

DOCUMENT: This variable is the relative weight that is being given to the probability of being bullied. Moskalenko et al. (2022) found that having been bullied is prevalent in the Incel community. This is why the relative weight of being bullied is set at 50%, or 0.5

---

relative_weight_media_vilification = 0,5

UNITS: Dimensionless

DOCUMENT: This variable accounts for the relative weight that is given to the "effect of media vilification on extremization". Tomkinson et al. (2020) describes how mass media reporting on Incels

can encourage engagement in violence by those who feel like they are being persecuted. This is why the relative weight is set at 50% or 0.5

Sensitivity_of_extreme_posts_on_extremization = 0,1

UNITS: Dimensionless

DOCUMENT: The sensitivity of extreme posts on extremization accounts for how proportional the effect of extreme posts is on extremization. The value is set at 0,1, because more extreme posts on Incel forums means that those views and beliefs become normal and posts need to become even more extreme to increase the probability of extremization.

Sensitivity_of_posts_on_interest = 0,5

UNITS: Dimensionless

DOCUMENT: Sensitivity of posts on the interest accounts for how proportional the effect of posts prevalence is on interest. The value is set at 0.5, because when there are more posts it does not mean these posts are all relevant to become interested. This will cause less engagement and thus a weaker effect.

susceptibility_to_radicalization = probability_of_loneliness_in_society*weight_loneliness + probability_of_being_bullied_in_society*weight_being_bullied + probability_of_mental_health_issues_in_society*weight_mental_health

UNITS: Dimensionless

DOCUMENT: This variable accounts for the susceptibility to the radicalization process. It multiplies the probability of mental health, loneliness and being bullied with their respective weight and then adds them together. These three conditions have been found to be prevalent in the Incel community (RAN, 2021).

Threshold_for_alienation = 0,2

UNITS: Dimensionless

DOCUMENT: This parameter represents the threshold of alienation. The value is assumed to be 20% or 0.2.

time_to_leave_the_collective_memory = 24

UNITS: Month

DOCUMENT: This is a constant and represents the amount of time a forum post needs to be eventually forgotten. The value is assumed to be 24 months, based on personal experience with social media/forum posts.

Total_Incel_Community = Incels + Incel_Extremists

UNITS: People

DOCUMENT: This is a variable that represents the total Incel community, and thus includes both the Incels and the Incel Extremists. Incels and Incel Extremists are added together to represent the total Incel community.

---

total_Incel_forum_posts = Incel_forum_posts + Extreme_Incel_forum_posts

UNITS: Post

DOCUMENT: This is a variable that represents the total amount of Incel related forum posts. It adds "Incel forum posts" and the "Extreme Incel forum posts" together to account for the total amount of posts on the various Incel forums.

Total_Population = Incel_Extremists + Incels + Interested + Disinterested

UNITS: People

DOCUMENT: This variable represents the total population used in this model. It is the sum of the stocks of Disinterested, Interested, Incels and Incel Extremists.

---

weight_alienation = (1-weight_Extreme_forum_posts)*(1-relative_weight_media_vilification)

UNITS: Dimensionless

DOCUMENT: This variable is the weight that is given to the "effect alienation on the probability of extremization". The value is the remaining fraction of the weight of Extreme forum posts multiplied by the remaining fraction of the weight of media vilification.

---

weight_being_bullied = (1-weight_mental_health)*relative_weight_being_bullied

UNITS: Dimensionless

DOCUMENT: This variable is the actual weight which is given to the "probability of being bullied in society". To get the value, the remaining fraction of the weight of mental health is multiplied with the relative weight of being bullied.

---

weight_Extreme_forum_posts = 0,5

UNITS: Dimensionless

DOCUMENT: This variable represents the weight that is given to the "effect of extreme Incel forum posts on extremization". Because the Incel community is an online community the radicalization process is online. Regher (2022) noted the normalization and amplification of extreme, violent and misogynistic beliefs and views through the echo-chamber effect of the internet, which are consumed regularly. That is why the weight of extreme forum posts is 50% or 0.5

weight_loneliness = (1-weight_mental_health)*(1-relative_weight_being_bullied)

UNITS: Dimensionless

DOCUMENT: This variable is the weight that is given to the "probability of loneliness in society". The value is the remaining fraction of the weight of mental health multiplied by the remaining fraction of the weight of being bullied.

---

weight_media_vilification = (1-weight_Extreme_forum_posts)*relative_weight_media_vilification

UNITS: Dimensionless

DOCUMENT: This variable represents the actual weight given to the "effect of media vilification on extremization". To get the value, the remaining fraction of the weight of Extreme forum posts is multiplied with the relative weight of media vilification.

---

weight_mental_health = 0,5

UNITS: Dimensionless

DOCUMENT: This variable accounts for the weight that is being given to the parameter "probability of mental health issues in society". Research by Moskalenko et al. (2022) has shown that 95% of the questioned Incels had self-diagnosed depression. Because of these high numbers, the weight of 50%, or 0.5, is used.

Appendix B: Model Testing

Integration Error Test

The model was tested with two integration methods; Euler's method and the fourth order Range-Kutta. It was furthermore tested with a time step of 1/16 and 1/32. The behaviour of the simulations remained the same for DT 1/16 and 1/32, as well as for Euler's method and fourth order Runge-Kutta. Therefore, Euler's integration method was chosen with a DT of 1/16.

        The time unit is in Months. This was chosen due to the data found during the literature review, where information on forum posts and visitors was given in Months. The time period is set at 60 months, or 5 years. This was chosen due to the recent growth of the Incel community, and the objective to reproduce this recent behaviour.

Sensitivity Analysis

The sensitivity of the model was tested for all parameters (see Table 3) and all the table functions. For the parameters, the sensitivity was tested using 6 runs with Uniform Distribution, Latin Hypercube sampling. After the initial 6 runs, the parameter "Probability of de-extremization" which showed behavioural sensitivity, was tested with 50 runs. This was done to assure as many behavioural changes as possible were detected. There were not any significant new behavioural patterns found, so the graphs with 6 runs will be shown in the analysis.

        For the table functions, the sensitivity analysis was conducted by changing the shape and the min and max values. The model simulation was captured in between changes, and displayed in comparative graphs.

Table 3. Overview of all the parameters tested in the sensitivity analysis.

| Variabel	Sensitive	Type of Sensitivity	Range
Sensitivity of posts of interest	Sensitive	Numerical	Min: 0.1 Max: 1
Maximum effect on interest	Not significant	Numerical	Min: 5 Max: 20
Initial probability of getting interested	Sensitive	Numerical	Min: 0.01 Max: 0.1
Probability of losing interest	Sensitive	Numerical	Min: 0.1 Max: 1
Probability of deradicalization	Sensitive	Numerical	Min: 0.1 Max: 1
Probability of loneliness in society	Not significant	Numerical	Min: 0.1 Max: 1
Probability of being bullied in society	Not significant	Numerical	Min: 0.01 Max: 1
Probability of mental health issues in society	Sensitive	Numerical	Min: 0.01 Max: 1
Threshold for alienation	Not sensitive	Not sensitive	Min: 0.01 Max: 0.5
Initial probability of radicalization	Sensitive	Numerical	Min: 0 Max: 1
Adjustment time	Not significant	Numerical	Min: 1 Max: 24
Initial probability of extremization	Sensitive	Numerical	Min: 0 Max: 1
Maximum effect on extremization	Sensitive	Numerical	Min: 0 Max: 20

Sensitivity of extreme posts on extremization	Not significant	Numerical	Min: 0 Max: 1
Media adjustment time	Not significant	Numerical	Min: 1 Max: 24
Mass media exposure multiplier	Not sensitive	Not sensitive	Min: 0.5 Max: 2.5
Average radical acts per extremist	Sensitive	Numerical	Min: 1 Max: 10
Average preparation time	Sensitive	Numerical	Min: 5 Max: 15
Probability of de-extremization	Sensitive	Behavioural*	Min: 0 Max: 1
Probability of extremists committing radical acts	Sensitive	Numerical	Min: 0 Max: 1
Fraction de-extremization back to Incel	Not sensitive	Not sensitive	Min: 0 Max: 1
Time to leave the collective memory	Sensitive	Numerical	Min: 6 Max: 24
Average Incel posts per Incel per month	Sensitive	Numerical	Min: 0 Max: 30
Average extreme posts per Incel per month	Sensitive	Numerical	Min: 0 Max: 30
Weight mental health	Not significant	Numerical	Min: 0 Max: 1
Relative weight being bullied	Sensitive	Numerical	Min: 0 Max: 1
Weight Extreme forum posts	Sensitive	Numerical	Min: 0 Max: 1
Relative weight media vilification	Not significant	Numerical	Min: 0 Max: 1
Initial Disinterested	Sensitive	Numerical	Min: 700,000,000 Max: 2,100,000,000
Initial Interested	Not sensitive	Not sensitive	Min: 3,800,000 Max: 11,400,000
Initial Incels	Not significant	Numerical	Min: 12,500 Max: 55,500
Initial Incel Extremists	Not significant	Numerical	Min: 1250 Max: 5550
Initial Incel Forum posts	Not significant	Numerical	Min: 140,000 Max: 420,000
Initial Extreme Forum posts	Not significant	Numerical	Min: 35,000 Max: 105,000
Initial Radical acts	Not sensitive	Not sensitive	Min: 0 Max: 10

Sensitivity of posts of interest:
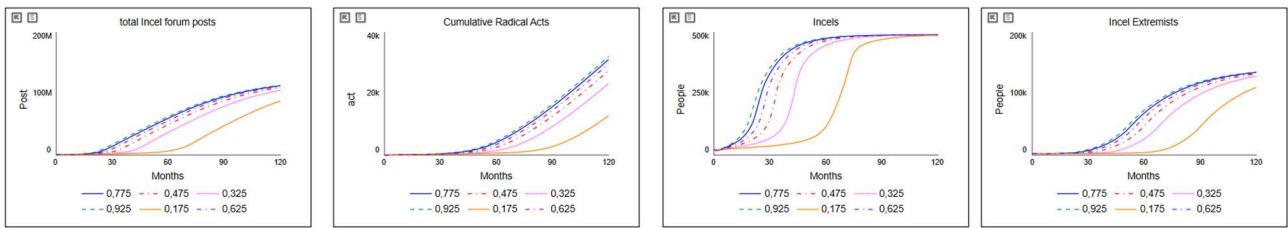
The model is sensitive to this parameter. This is to be expected. The smaller the *value of sensitivity of posts on interested* is, the smaller the effect of post prevalence on the *probability of getting interested is*. This means that the probability of getting interested does not increase as fast and it takes longer for disinterested to become interested in Incel related content. Only a sensitivity around the value of 0.2 gives a significant numerical sensitivity, but even then the behaviour of the model remains similar. The total amount of Incels will still be reached, as well as for the values of total Incel forum posts, Cumulative radical acts and Incel extremists.

Initial probability of getting interested:
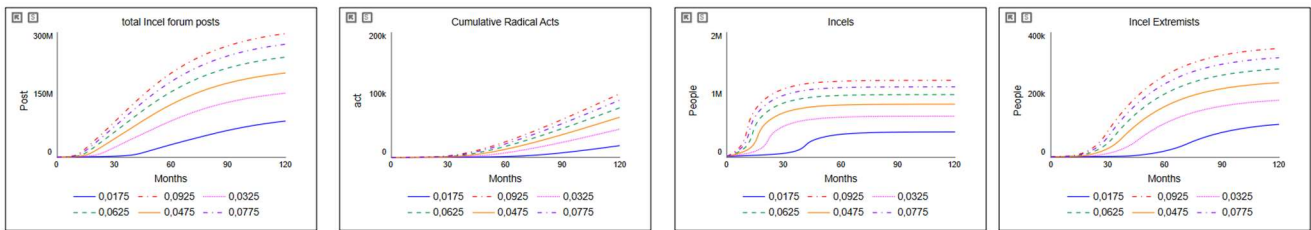
The model is sensitive to this parameter. Similar to the above mentioned *sensitivity of posts on interest*, *the initial probability of getting interested* is numerical sensitive. A lower or higher initial probability will determine how many people become interested in the Incel ideology and eventually how many Incels and Incel Extremists there will be. And thus also how many Incel forum posts and Radical acts. In this case, the base value of *initial probability of getting interested* is calibrated based on data reflecting the amount of people visiting Incel forums (Lough, 2022), and will be used in the model.

Probability of losing interest:
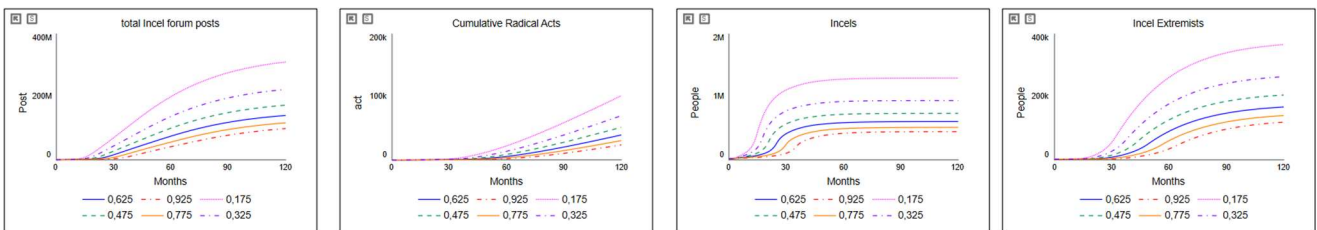
Comparable to the *initial probability of getting interested*, the model is numerical sensitive to the *probability of losing interest*. This is to be expected, seeing as a higher *probability of losing interest* would move more people from the *Interested* stock back to the *Disinterested* stock. A lower *probability of losing interest* means that there would be more people left in the *Interested stock*, meaning potentially more people who could radicalize into an *Incel* and *Incel extremist*. And thus also leading to more Incel forum posts and Radical acts. The initial value of *probability of losing interest* used is based on data found in the literature (see Pelzer et al., 2021), and will be used in the model.

Probability of deradicalization:
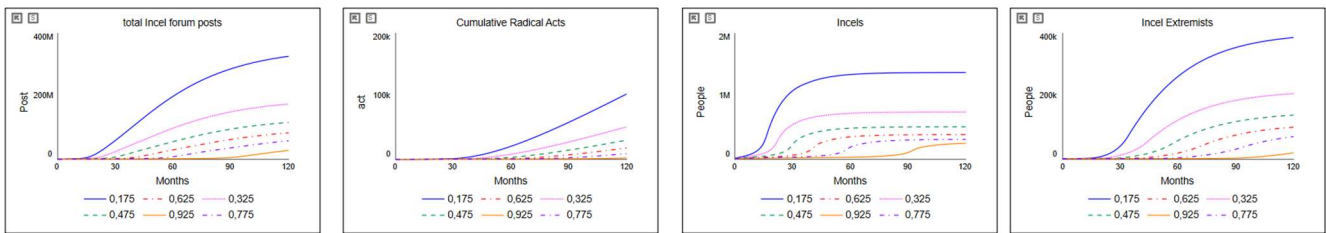
The *probability of deradicalization* is responsible for the potential amount of Incels deradicalizing per month. A higher probability would mean that more people could potential be moved from the *Incel* stock, back to the *Disinterested* stock. A lower probability means that less people deradicalize, and that there thus be more Incels left in the stock, who could potentially become *Incel Extremists.* Which in turn increases the *Incel forum posts* and *Radical acts*. The model is numerical sensitive to this variable. While the initial value of *probability of deradicalization* is based on data (see Pelzer et al., 2021), and will be used in the model, further research on this value should be conducted in order to portray an as precise situation as possible.

Probability of mental health issues in society:
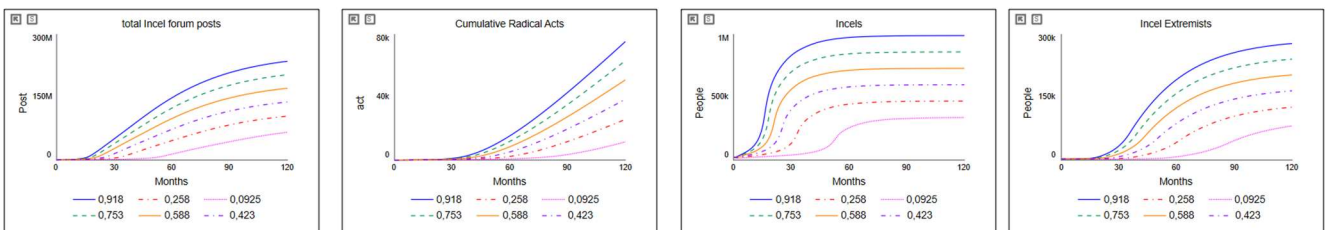
The model is numerical sensitive to the parameter *probability of mental health issues in society*. This is an exogenous parameter that increases *the susceptibility to radicalization* of *potential radicals.* If the *probability of mental health issues in society* increases, the *susceptibility to radicalization* increases and more *Interested* people will become *Incels* and potentially *Incel Extremists*. This in turn, would also increase the total Incel forum posts and Radical acts. The initial value of *probability of mental health issues in society* reflects the percentage of men struggling with mental health issues in society (Moskalenko et al., 2022), and will be used in the model. This parameter is, however, an interesting leverage point for future policies.

Initial probability of radicalization:
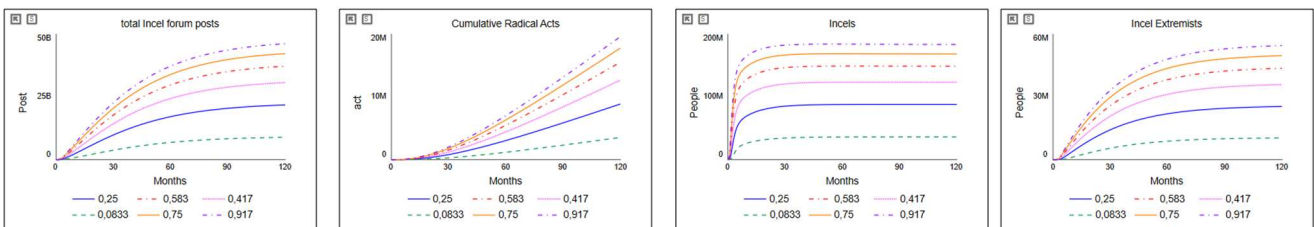
The model is sensitive to this parameter, which is to be expected. The *Initial probability of radicalization* will eventually determine how many people from the *Interested* stock will become *Incels* and potential *Incel Extremists*. If the *initial probability of radicalization* is lower, less people will become *Incels* and potential *Incel Extremists*. This would also lower the *Incel forum posts* and indirectly the *radical acts*. A higher probability would lead to increases. The value used for the *initial probability of radicalization* is found in the literature (see McCauley & Moskalenko, 2017), and will be further used in the model.

Initial probability of extremization:
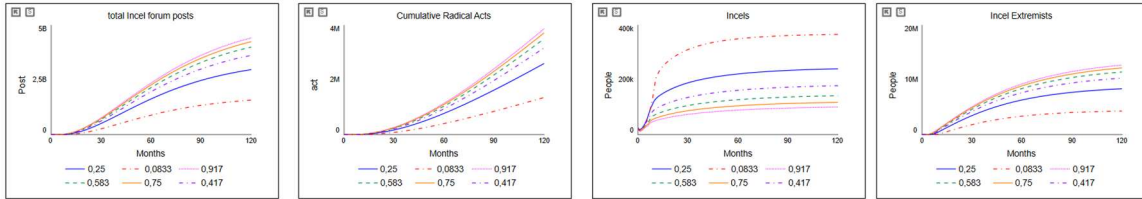
The model is numerical sensitive to the parameter *initial probability of extremization*. Similar to the abovementioned *initial probability of radicalization*, the *initial probability of extremization* determines how many *Incels* will further deradicalize into *Incel Extremists*. This has a direct influence on the amount of potential *Incel Extremists* but also on the *Cumulative Radical acts*. A lower initial probability would lower the amount of *Incel Extremists, radical acts* and *Incel forum posts*, but it would increase the amount of *Incels* because less of them would further extremize. A higher initial probability would increase *Incel Extremists, total forum posts* and *radical acts*, but decrease *Incels* because more of them would become extremists. The value used in the model for this parameter is based on existing extremists (see START, 2019) and thus will be further used. However, future research on this parameter is encouraged to present the most accurate value as possible.

Maximum effect on extremization:
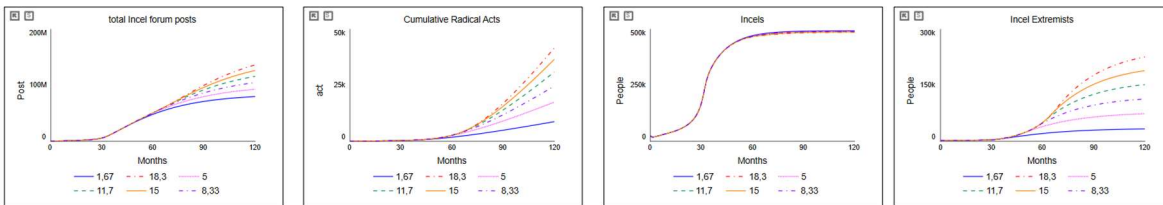
The model is partially sensitive to this parameter, it is not sensitive for the stock of *Incels* and not significantly sensitive for *total Incel forum posts*. This is because the parameter *maximum effect on extremization* influences the effect *extreme Incel posts* has on the *probability of extremization*. The maximum effect will only be used in case the effect of extreme Incel posts becomes too big. A lower maximum effect will decrease the probability of extremization, which means there would be less Incel Extremists. And a higher maximum effect will increase the probability of extremization, which would increase the amount of Incel Extremists and Radical acts. The initial value is choses to prevent the value of probability of extremization to become too high, but further research on this should be conducted.

Average radical acts per extremist:
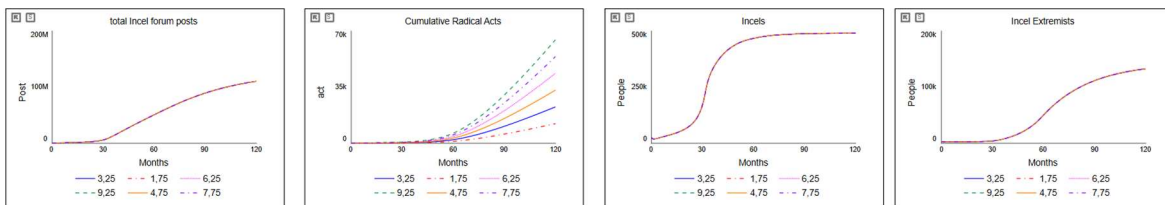
The model is partially sensitive to the parameter *average radical acts per extremist*. This parameter directly affects the inflow of the stock *Cumulative Radical acts.* This mean that if the amount of average radical acts per extremists changes, so will the cumulative of radical acts. Looking at the other stocks, *Incel forum posts, Incels* and *Incel Extremists*, the model is not sensitive to this parameter. Because of this, and because the average radical acts is based on the actual average acts of known Incels (see model documentation), the initial value of average radical acts per extremists will be used.

Average preparation time:
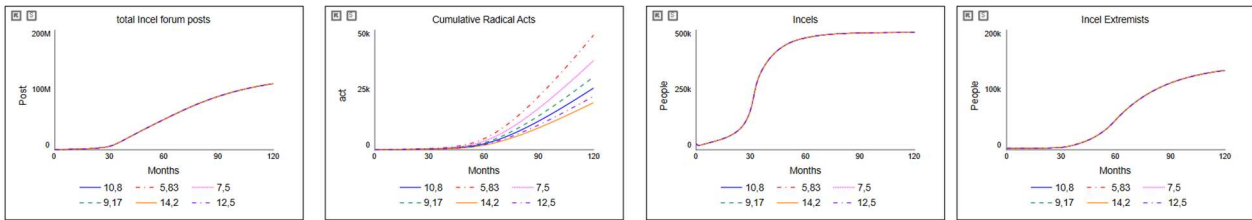
The model is only sensitive to this parameter for the stock of *Cumulative Radical acts*. This is to be expected, because *average preparation time* has an influence on the inflow of *Cumulative radical acts* and only an indirect and delayed effect on the inflows for the stocks of *Incels* and *Incel extremists*. If the average preparation time increases, it will take longer for extremists to perpetrate radical acts and the cumulative will thus decrease. If the average preparation time decreases, extremists need less time to commit acts and the cumulative will increase. In this case, the average preparation time is calculated based on the preparation times of known Incel extremists who have committed radical acts (see model description), and thus will be further used.

Probability of de-extremization:
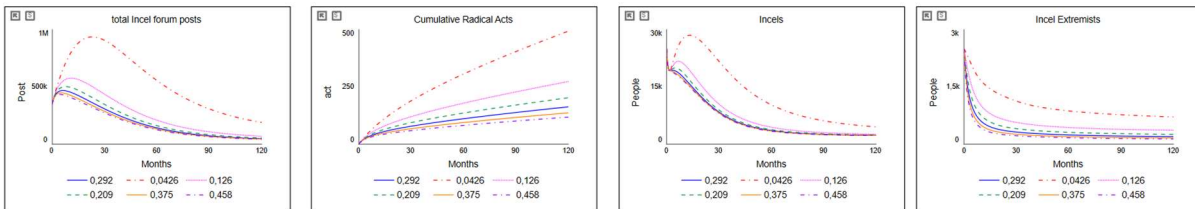
The model is behavioural sensitive to the parameter *probability of de-extremization*. This means that if the *probability of de-extremization* increases, the behaviour of the model changes. There will no longer be an increase in *Incels* and *Incel Extremists*, but a decrease. This in turn would mean that there is a decrease in *total Incel forum posts*, which leads to less people coming into contact with Incel related content. And thus less people becoming *interested* in the Incel ideology, which further decreases the amount of *Incels* and *Incel Extremists*. The initial value of *probability of de-extremization* is based on findings in the literature (see model documentation), and will be further used in the model. However, this is an important finding and makes for an excellent leverage point for future policies.

**Probability of extremists committing radical acts:**
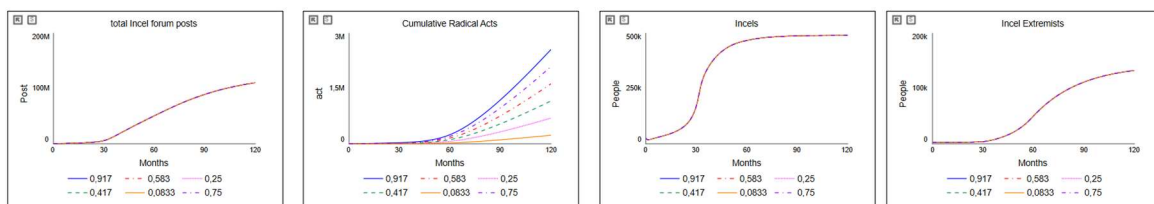
The model is partially sensitive to this parameter. The *probability of extremists committing radical acts* has an effect on the inflow of *Cumulative radical acts*. If the probability of committing radical acts increases, there will be more extremists committing radical acts and thus a higher total of radical acts. If the probability decreases, there will be less extremists committing radical acts, which in turn means less cumulative radical acts. A lower or higher probability does not cause a change in the other three stocks. The initial value used is based on findings in the literature (see model documentation), and will be used.

**Time to leave the collective memory:**
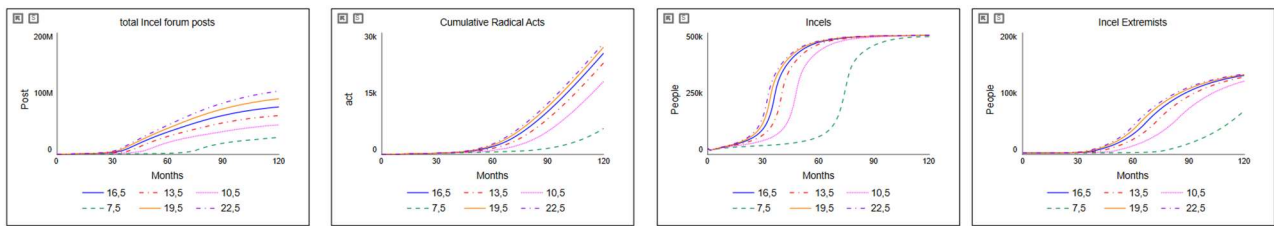
The model is numerical sensitive to this parameter. While *time to leave the collective memory* has an effect on the *total Incel forum posts*, a lower amount of forum posts would mean that less people come into contact with Incel related content and thus less people would become interested in the Incel ideology. While this would lead to less *Incels* and *Incel Extremists*, the graph shows that over time the stock of Incels reaches the same levels as with an increased *time to leave the collective memory*. A decreased value of *time to leave the collective memory* leads to less *Incel forum posts*, it seems to only slow down the growth of *Incels* and *Incel Extremists*. To get the most realistic situation, further research on this parameter is encouraged.

Average Incel posts per Incel per month:
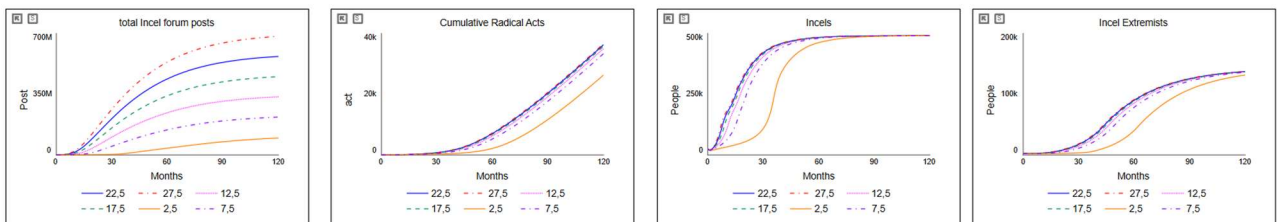
The model is moderately sensitive to this parameter. The *average Incel posts per Incel per month* has a direct effect on the *total Incel forum posts*. And increased average means a higher total amount of posts and a lower average means less Incel forum posts. This leads to more Incel related content or less Incel related content for Disinterested people to come into contact with. Interestingly enough, the higher amounts of average posts per Incel does not significantly change the amount of *Incels, Incel Extremists* and *Radical acts*. Only the lower average amount of Incel posts shows a significant numerical difference, but over time the same levels of Incels and Incel Extremist are reached. While Incel forum posts does have an effect on the amount of Incels and Incel Extremist it is not the only factor. The initial value of this parameter is calculated based on data regarding Incel forums (see model documentation). For a more precise value, further research is encouraged.

Average extreme posts per Incel per month:
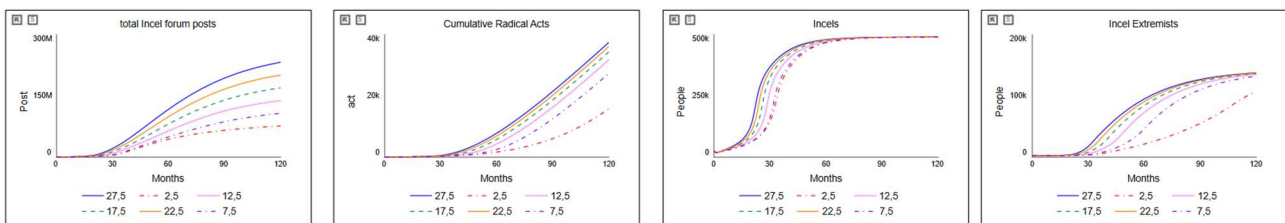
The model is moderately sensitive to this parameter. The stock of Incel is not significantly sensitive to this parameter, and compared to the abovementioned *average Incel posts per Incel per month*, neither is the stock of *total Incel forum posts*. Comparable to *average Incel posts per Incel per month*, only a much lower value shows a significant numerical change for the stock of *Incel Extremists* and *Cumulative radical acts.* However, over time similar levels are still reached. The initial value of this parameter is calculated based on data regarding Incel forums (see model documentation). For a more precise value, further research is encouraged.

**Relative weight being bullied:**
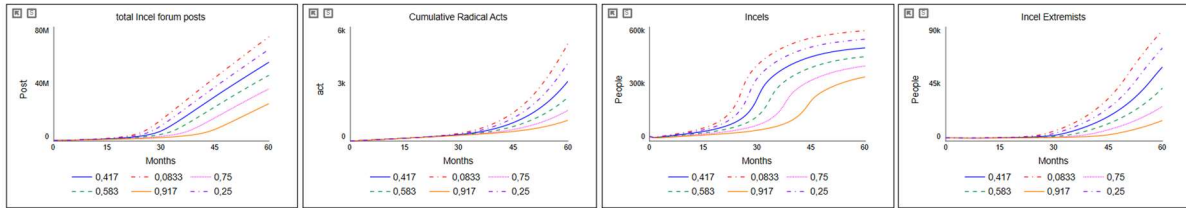
The model is moderately sensitive to this parameter. An increase in the *relative weight being bullied* leads to a higher *susceptibility of radicalization* which means that there are potentially more people radicalizing from *Interested* into *Incels*. This would also mean that there are potentially more *Incel Extremists*, leading to more committed radical acts. And a general increase in *Incels* and *Incel Extremists* also leads to more *Incel forum posts*. Which in turn leads to more people getting into contact with Incel related content and becoming Interested and potential Incels. A decrease in the *relative weight being bullied* leads to a lower *susceptibility of radicalization* and thus less potential people radicalizing into *Incels* and *Incel Extremists*. Being bullied is prevalent in the Incel community. For a more precise value, future research is encouraged.

Weight Extreme forum posts:
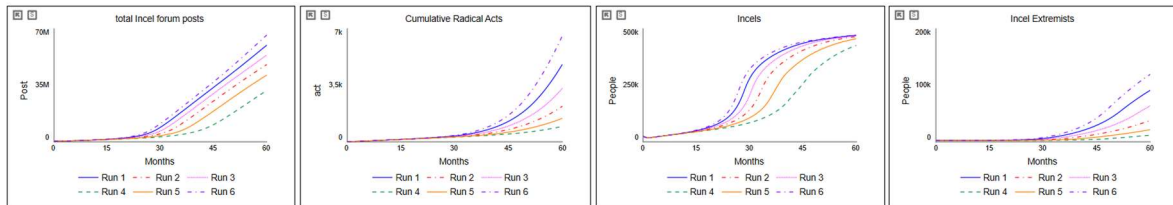
The model is moderately sensitive to this parameter. The *weight extreme forum posts* determines the weight extreme forum posts will have on the *probability of extremization.* An increased weight will increase the probability of extremization, which means that there will be more Incel Extremists. This leads to an increase in committed radical acts an Incel forum posts. And eventually, through a greater possibility of coming into contact with Incel related content, more Interested and thus more Incels. A decrease of the parameter would have the opposite effect. The Incel community is an online community, radicalization and extremization happens predominately online, which is why the initial value was chosen. For a more precise value, future research is encouraged.

Initial Disinterested:
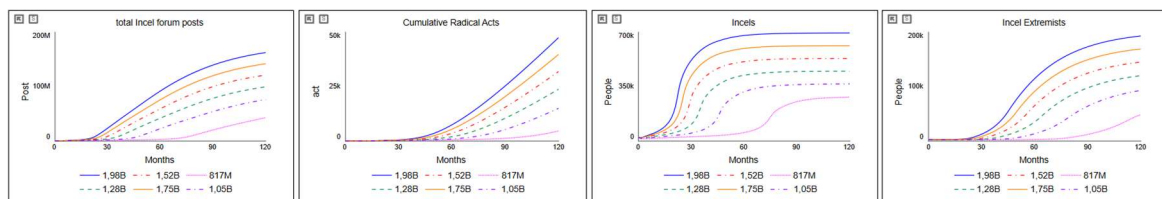
The model is sensitive to this parameter. That is to be expected. The parameter *Initial Disinterested* is responsible for nearly the total amount of people in the whole model. If the initial value of *Initial Disinterested* increases or decreases, it would directly affect the amount of people moving through the model and thus the amount of people who could potentially become an *Incel* or *Incel Extremists*. That would in turn leads to a change in *total Incel forum posts* and *cumulative radical acts*. The value of *Initial Disinterested* is based on the male internet users in the age group that most Incels seem to be in (see model documentation), and will be used in the model. For precision purposes future research is encouraged because value of Initial Disinterested does not include the male group of 15-18 years old.

Effect alienation on the probability of extremization:
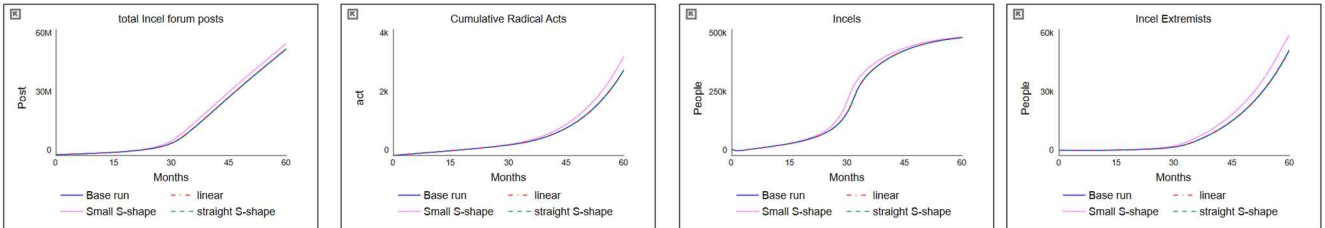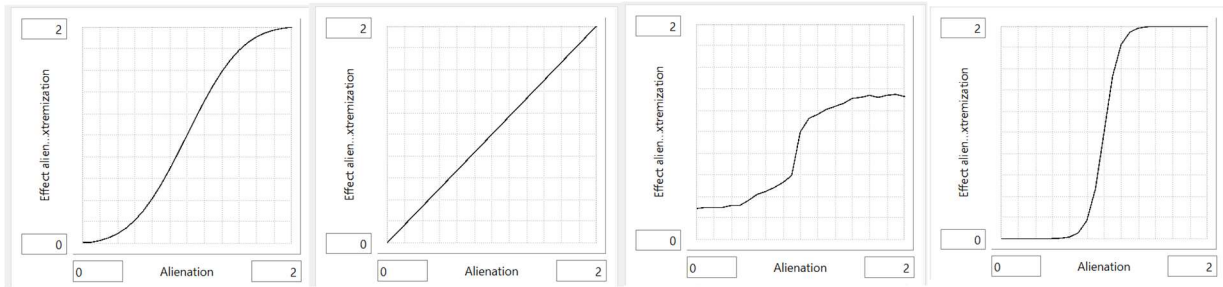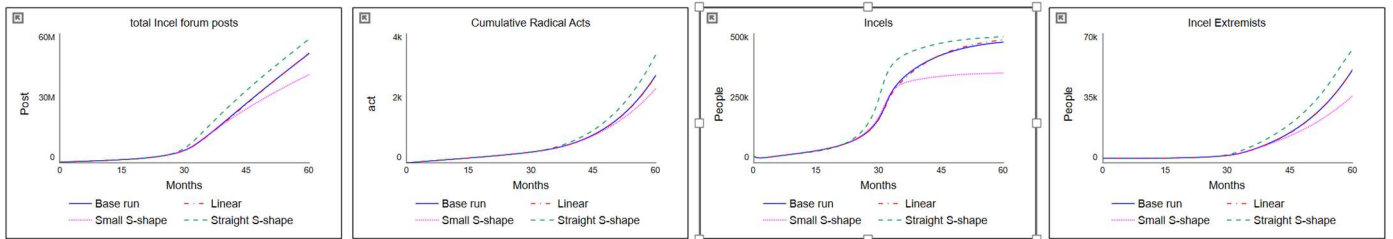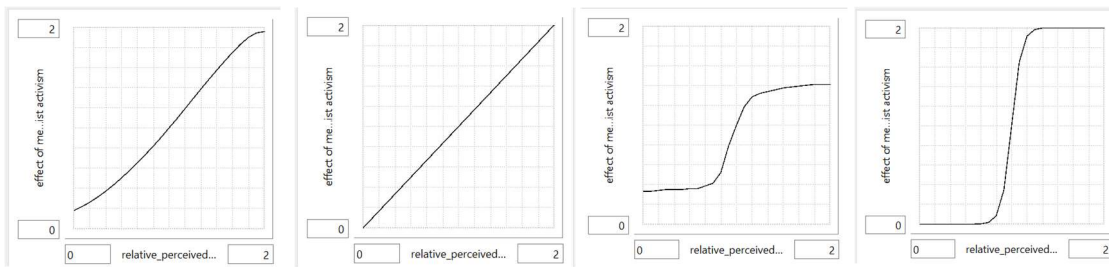

The model is not significantly sensitive to this table function, neither behavioural nor numerical. The effect and the output of the stocks remains the same.

**Effect of radical acts on social media glorification:**
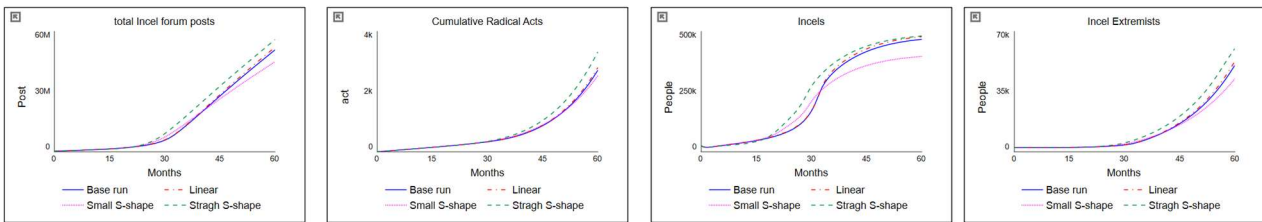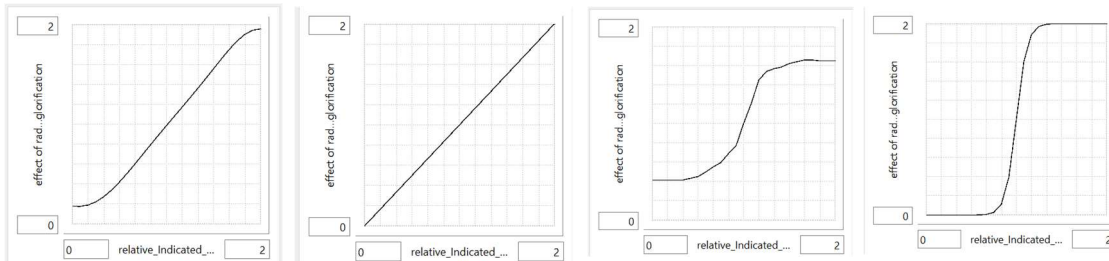
The model is moderately numerical sensitive to this table function. A lower effect of social media glorification (the purple line) will lead to less Incels. Which is to be expected because the table function has an effect on the probability of radicalizing into an Incel. Only the stock of Incels shows an moderate numerical sensitivity, it is not significant for the other three.

**Effect of media exposure on Feminist activism:**

The model is numerical sensitive to this table function. The straight table function (green line) leads to an insignificant increase in Incel forum posts, radical acts, Incels and Incel Extremists. A lower effect of feminist activism leads to an insignificant decrease in Incel forum posts, radical acts and Incel Extremists. There is a significant decrease in Incels. The behaviour, however, remains the same for all four.

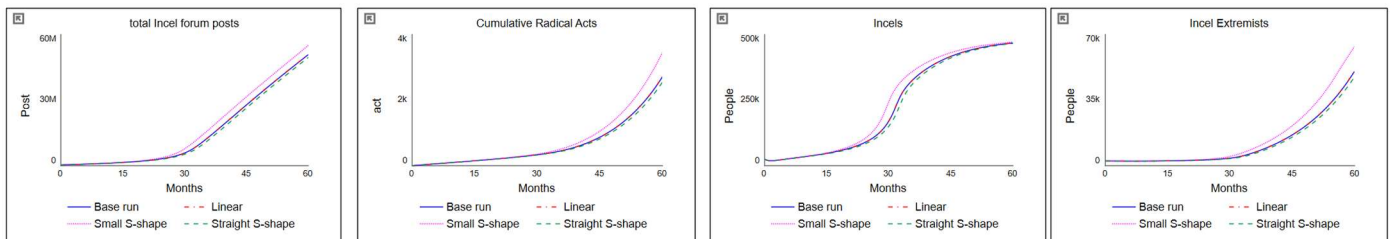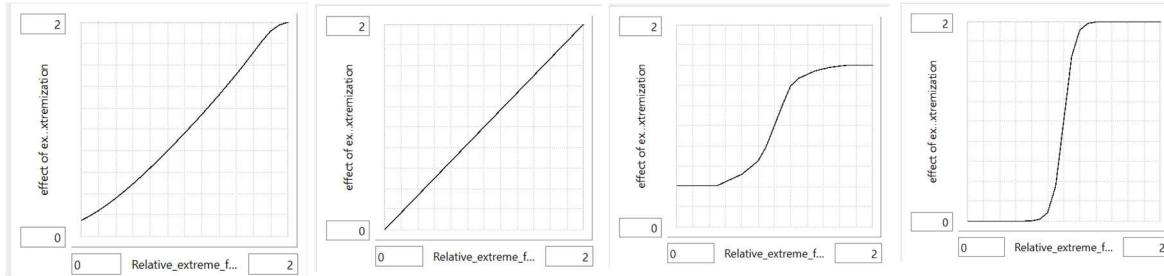**Effect of media vilification on extremization:**
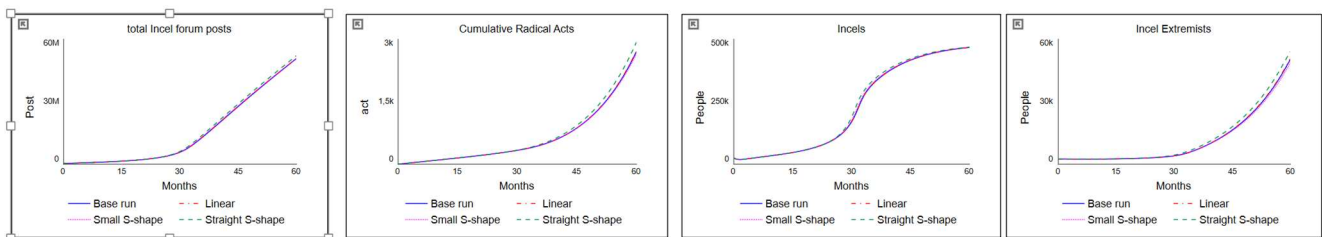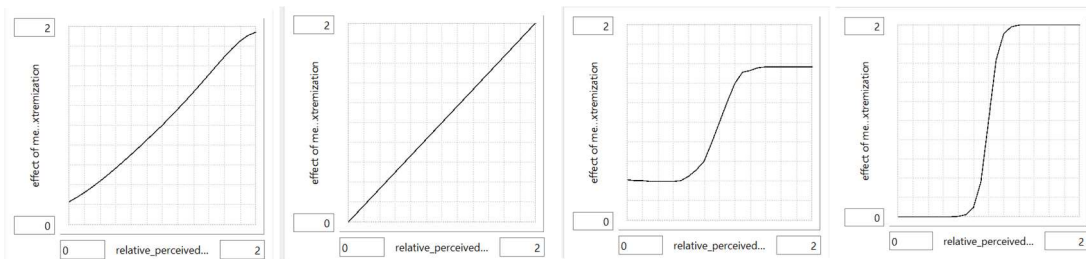
The model is not significantly sensitive to this table function, neither behaviour or numerical. The effect and the output of the stocks remains the same.

Effect of radical acts on de-extremization:
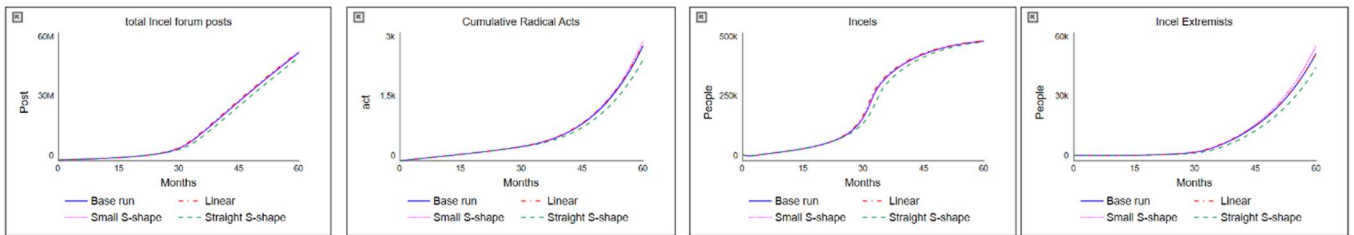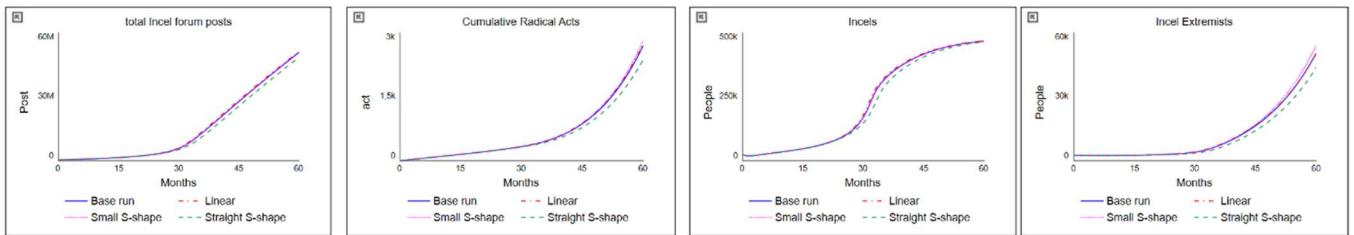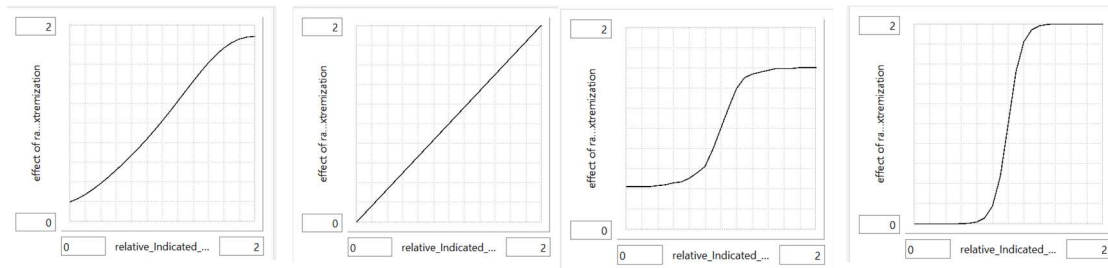
The model is not significantly sensitive to this table function, neither numerical nor behavioural. The effect and the output of the stocks remains the same.

Effect of extreme forum posts on de-extremization:

The model is not significantly sensitive to this table function, neither numerical nor behavioural. The effect and the output of the stocks remains the same.

Effect of radical acts on deradicalization:

The model is numerical senstive to this table function. The different effects achieve a lower amount of Incel forum posts, radical acts, Incels and Incel Extremists. The behaviour of the stock is still the same. However, the other effects have an maximum effect of 2. This would mean that with the effect of radical acts on deradicalization, the probability of deradicalization will be at 100%. That is highly unlikely, because there will always a small group of people becoming extremists. Therefore, the original table function will be used. It is a good leverage point for policies.
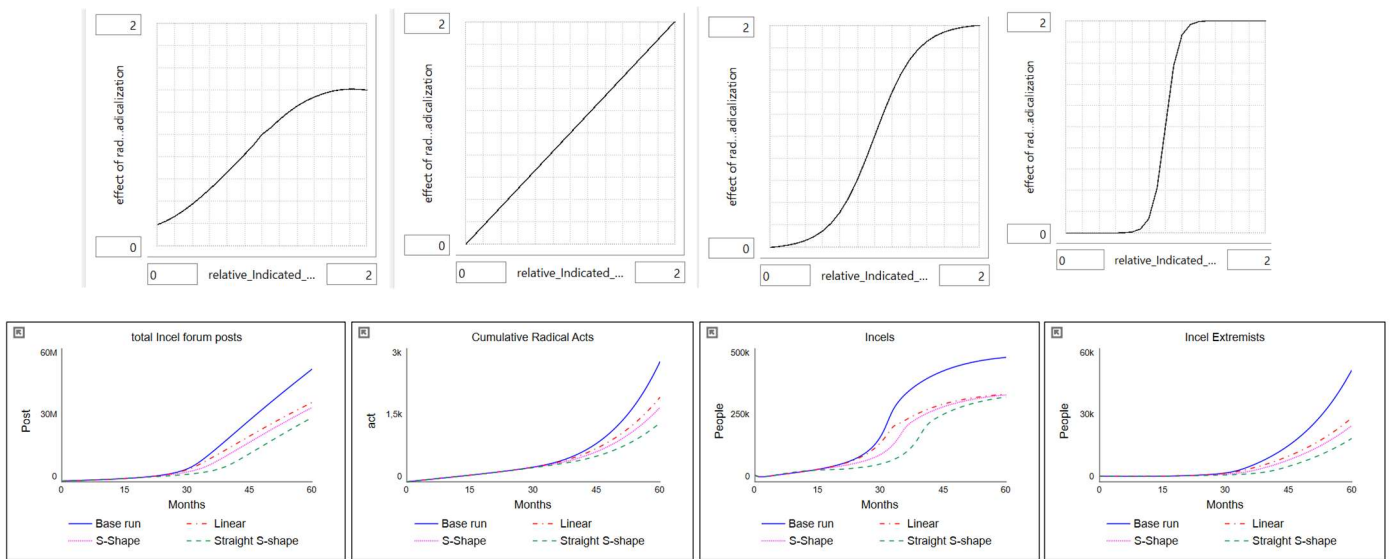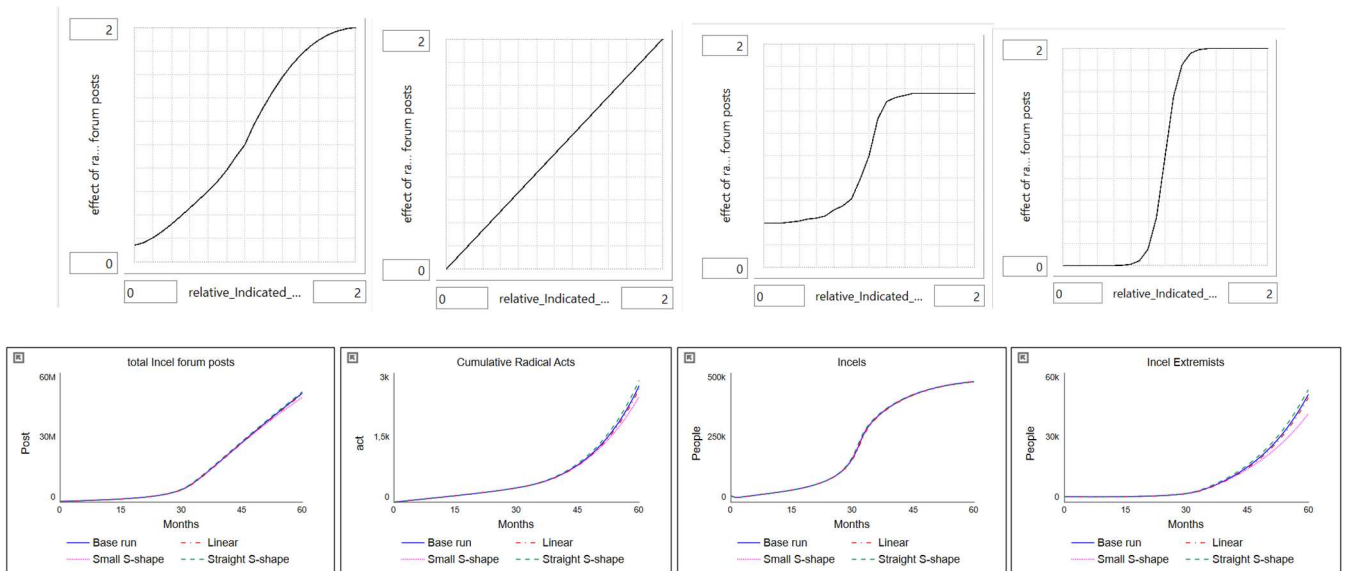
Effect of radical acts on Extreme forum posts:

The model is not significantly sensitive to this table function, neither numerical or behavioural. The effect and the output of the stocks remains the same.

Effect of radical acts on Incel forum posts:
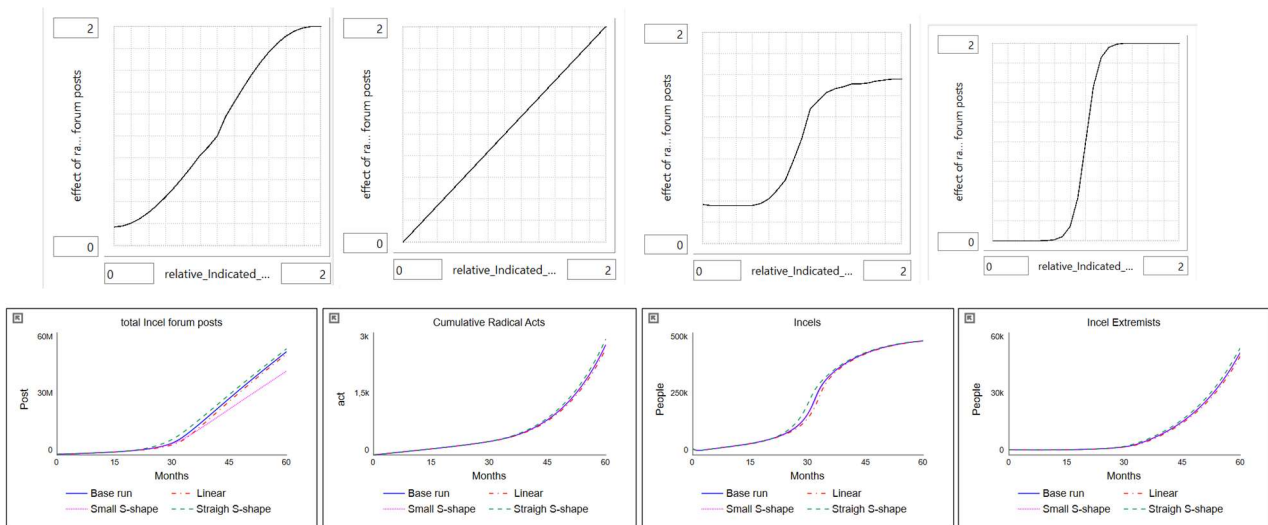

The model is not significantly sensitive to this table function. A lower effect of radical acts on forum posts (pink line) leads to a small decrease in total Incel forum posts. This is because the table function influences the generating process of Incel forum posts. However, the behaviour is still the same, and the values and behaviour of the other three stocks remain the same.

Appendix C: Policy scenarios simulation settings

This section focusses on the policy scenarios. The minimum reporting guidelines as recommened by Rahmandad & Sterman (2012) are followed.

The integration method used is Euler's method, with a DT of 1/16. The time unit is in Months, with a time period of 60 months.

1. Base scenario
This is the base scenario, it is used to reproduce the reference mode. In order to simulate this scenario:

SWITCH Incel post ban = 0
SWITCH Extreme post ban = 0

2. Banning posts scenario
In this scenario, the policity of banning Incel posts is simulated. This is done to minimialise the Incel content on the internet, and prevent men from radicalizing into Incels, and to prevent Incels in further extremizing into Incel Extremists. In order to duplicate this, two outflows are added, along with accompanying parameters and Switches.

SWITCH Incel post ban = 1
SWITCH Extreme post ban = 1

3. Mental Health services scenario
This simulation provides the scenario of men going to therapy or getting a mental health intervention. The sensitivity analysis showed significant numerical sensitivity for the parameter "probability of mental health issues in society". If this probability goes down, less men will have mental health issues in society, which makes fewer men susceptible to radicalization into an Incel.

SWITCH Incel post ban = 0
SWITCH Extreme post ban = 0

Probability of mental health issues in society = 0.1

4. Deradicalization programs scenario
This scenarios accounts for authorities investing into deradicalization programs for Incels. Deradicalization programs exist to help extremists disengage from their ideology, move away from the violence and extremist beliefs and start a new life. The sensitivity analysis showed significant behavioural sensitivity of the parameter "probability of de-extremization". This indicates that when the probability of de-extremization is increased, there will no longer be an increase in Incels and Incel Extremists, along with total Incel forum posts, but a decrease. Deradicalization programs can help to increase the probability of de-extremization.

SWITCH Incel post ban = 0
SWITCH Extreme post ban = 0

Probability of de-extremization = 0.1

5. Documentation Policy scenario

FLOW

Banning_Extreme_posts = IF Switch_Extreme_post_ban = 1 THEN Extreme_Incel_forum_posts*probability_of_Extreme_posts_getting_banned ELSE 0

UNITS: Post/Months

DOCUMENT: This is a flow, it is an outflow of the stock of Extreme Incel forum posts. It represents the policy of banning inappropriate posts in order to prevent Incel content to further take over the internet and normalizing Incel beliefs. With the banning of Extreme posts, the hope is that less men see the content and thus fewer men become interested in the ideology. It is also aimed at preventing the further extremizing of Incels into Incel Extremists, because the more extreme posts normalize and instigate violence.

FLOW
Banning_Incel_posts = IF Switch_Incel_post_ban = 1 THEN Incel_forum_posts*probability_of_posts_getting_banned ELSE 0

UNITS: Post/Months

DOCUMENT: This is a flow, it is an outflow of the stock of Incel forum posts. It represents the policy of banning inappropriate posts in order to prevent Incel content to further take over the internet and normalizing Incel beliefs. With the banning of posts, the hope is that less men see the content and thus fewer men become interested in the ideology. Leading to less Incels and possible Incel Extremists.

---

probability_of_Extreme_posts_getting_banned = 0,2

UNITS: Dimensionless/month

DOCUMENT: This is a parameter. It is the probability that an extreme Incel post gets banned due to e.g. violent content, women hate or racism, on a monthly basis. There has been a distinction made between the more extreme posts and the more common posts. Because the more extreme posts are filled with misogyny, rape threats and overall toxicity, it is assumed that the probability of extreme Incel posts getting banned is 0.2 or 20%

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probability_of_posts_getting_banned = 0,05

UNITS: Dimensionless/month

DOCUMENT: This is a parameter. It is the probability that an Incel post gets banned due to e.g. violent content, women hate or racism, on a monthly basis. Because there has been a distinction made between the more extreme posts and the more common posts, it is assumed that the probability of Incel posts getting banned is 0.05 or 5%

Switch_Extreme_post_ban = 1

UNITS: Dimensionless

DOCUMENT: This is a switch. If the switch is on, and has a value of 1, the policy of banning Extreme Incel posts is active. If the switch is set at 0, the policy is not activated and the model runs without.

---

Switch_Incel_post_ban = 1

UNITS: Dimensionless

DOCUMENT: This is a switch. If the switch is on, and has a value of 1, the policy of banning Incel posts is active. If the switch is set at 0, the policy is not activated and the model runs without.

## 6. Sensitivity analysis banning posts policy scenario

The sensitivity of the banning posts scenario were tested for two parameters: probability of Extreme posts getting banned and probability of posts getting banned. The sensitivity was tested using 6 runs with Uniform Distribution, Latin Hypercube sampling.

Probability of Extreme posts getting banned
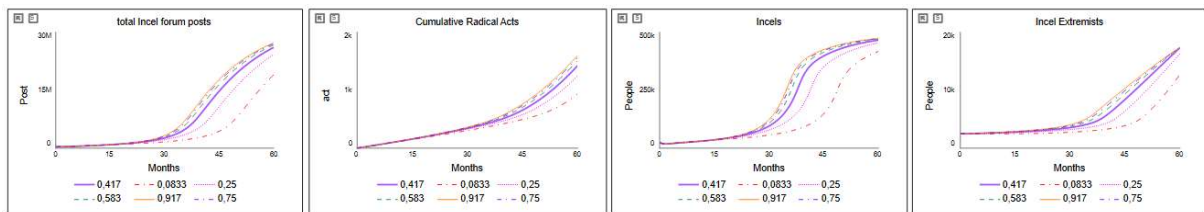
The value for the parameter was assumed to be 0,2. The sensitivity analyses shows numerical sensitivity, but the overal behaviour remains the same. Even for a very low value of 0,0833 (dash-dotted red line), near similar valus for the Total Incel forum posts, Incels and Incel Extremists are reached. This could be explained by the fact that the Extreme forum posts only make up a small part of the total Incel posts. For future reference, more research on this value should be conducted.

Probability of posts getting banned
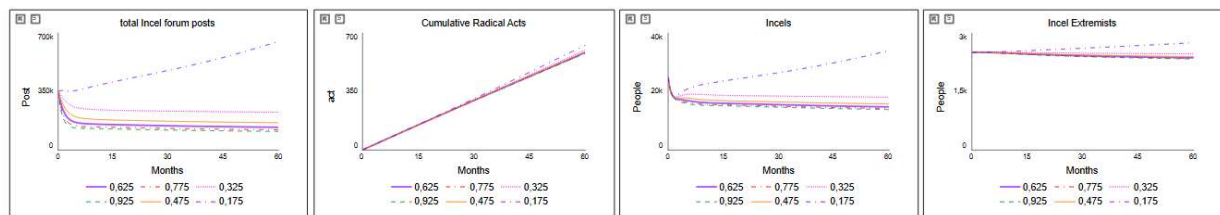
The value of the parameter was assumed to be 0,05. The sensitivity analysis shows behavioural sensitivity to this parameter. This shows that it is a well chosen policy scenario. The behavioural pattern change can be explained due to the fact that men become Interested in the Incel ideology though coming into contact with Incel related posts. Incel posts make up the majority of the Total Incel Forum posts, if the probability of posts getting banned increases there will be less total Incel posts. In turn there will be less men becoming interested in the ideology and thus a decrease in Incels and extremists. Radical acts keeps increasing because it is cumulative. However, it should also be noted that banning of posts and Incel forums has been done before, with the original Incel Reddit forum (Bell, 2017). Incels moved to other forums, which were more anonimous and less governed. These forums show to be growing in their toxicity and extreme violent language (Baele et al., 2023). This indicates policy resistance.

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