CREST Centre for Research and Evidence on Security Threats

Inoculating Against the Spread of Islamophobic and Radical-Islamist Disinformation

FULL REPORT

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This research was funded by the Centre for Research and Evidence on Security Threats – an independent Centre commissioned by the Economic and Social Research Council (ESRC Award: ES/N009614/1) and which is funded in part by the UK Security and intelligence agencies and Home Office.

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SUMMARY

Misinformation, disinformation, and propaganda are core components of radicalisation and extremism and apply equally to Islamist radicalisation and the generation of Islamophobia.

One method of countering disinformation is to inoculate the information consumer. Theoretically, inoculation should equip individuals with the ability to critically assess and refute misinformation/disinformation by revealing the general flaws in misleading communications before exposure.

This study, involving over 500 participants, examined the effectiveness of inoculating participants against Islamophobic and radical-Islamist disinformation.

Participants in the experimental (inoculation) condition watched a training video that explained common rhetorical markers of radical-Islamist and Islamophobic disinformation without, however, mentioning Islam at all. The control group watched a video about an unrelated topic.

Participants were then exposed to one of two scripted 'target' videos that constituted a potential entry point for either Islamist or Islamophobic radicalisation. The linguistically matched target scripts utilised three misleading techniques (hasty generalisations, polarisation and invoking emotion).

The analysis showed that participants who received the inoculation procedure displayed less agreement with the target video content, perceived the video as less reliable, and were less likely to share it in comparison to participants in the control group.

The inoculation findings are equally relevant to combating Islamophobia and Islamist extremism and provide an alternative approach to more conventional counter-messaging campaigns.

In the present study, the training video did not mention Islam or any issues related to radicalisation. The video nonetheless successfully inoculated people against being misled by two diametrically opposed radicalising positions. It follows that inoculation messages may be effective without the problems that may beset some other counter-messaging programs: neither lack of domain knowledge nor stigmatisation are likely to derail inoculation.

Overall, the results provide support for the use of inoculation in combating extremist messages and demonstrates the potential success of using inoculation to make people more resilient to extremist disinformation.

It should be noted, however, that the study did not measure the duration of the inoculation effect, nor compare inoculation to fact-checking or corrections. Future research could address these and other issues such as the effectiveness of inoculation in specific groups who are likely targets of extremists such as adolescents.

OVERVIEW

Misinformation refers to information that is either false or inaccurate. When misinformation is spread intentionally, for example in pursuit of a political agenda, we refer to it as disinformation. The potential dangers of misinformation and disinformation are well established. For example, misinformation about the link between vaccines and autism has led many people in the US refusing to vaccinate their children, thereby putting them at risk.

The recognition of the importance of disinformation and propaganda in radicalisation and extremism is not novel and applies equally to Islamist radicalisation and the generation of Islamophobia. For example, Radical-Islamist groups use the internet to spread disinformation and seek recruits, and sections of the media facilitate Islamophobia by consistently associating Islam with issues such as forced marriage and terrorism.

The current study describes and tests a method of countering disinformation, which is to inoculate the information consumer. Theoretically, inoculation should equip individuals with the ability to critically assess and refute misinformation by revealing the general flaws in misleading communications before exposure.

Inoculation involves two components: the first component is a reminder that politically motivated groups often distort or manipulate information in pursuit of their agenda. The second component explains the logical fallacies typically embedded in misinformation/disinformation and provides a pre-emptive refutation.

Existing research has demonstrated that inoculation can protect the public against flawed contrarian argumentation about climate change and misinformation in general. In one study, inoculation was also found to create resistance to extremist propaganda.

This study was the first to use inoculation to protect individuals against Islamophobic and radical-Islamist disinformation. In preparation for the current study, we used visual network analysis to identify Islamophobic and radical-Islamist videos on YouTube. We then analysed those videos to understand the techniques by which extremists mislead. Hasty generalisations, invoking emotion, and polarisation were common markers of Islam-related disinformation. (This analysis is reported in the *Appendix*.) From this work, we produced a training video that explained common rhetorical markers of radical-Islamist and Islamophobic disinformation, without however mentioning Islam at all.

In our study, 585 study participants, all of whom were living in the UK at the time of the study, were recruited through an online platform and randomly assigned to one of four groups; two groups to be exposed to an Islamophobic scripted video and two to be exposed to a scripted radical-Islamist video.

Half of each of these two groups were first inoculated against the information they received via a training video that explained how, in general, extremist videos frequently make hasty generalisations (jump to conclusions based on irrational reasoning) and invoke emotions such as fear, anger or empathy to polarise viewers. (The other halves of each group, serving as controls, were given a video about Bitcoin which had nothing to do with Islam or radicalisation.)

All participants then watched one of two scripted target videos, which (depending on assignment) displayed content that either might be a gateway to radical-Islamist or Islamophobic content. The Islamophobic and radical-Islamist videos were designed by harvesting background video ('B-roll') from Islam-related videos on YouTube.

The scripts for the target videos used the three misleading techniques (hasty generalisation, polarisation, and invoking emotion) in order. To ensure comparability of scripts between the two target videos, they were analysed using the Linguistic Inquiry and Word Count (LIWC) program which showed that the texts were similar in the word count for each rhetorical disinformation technique (hasty generalisations, invoking emotion,

polarisation) and in terms of the percentage of social words, positive words, and negative words used. Statistical analysis showed that in comparison with controls, participants in the inoculation condition were less likely to want to share the disinformation, perceived the disinformation as less reliable, agreed less with the misinformation, and indicated less support for the misinformation. These findings are in agreement with previous findings on the use of inoculation to increase people's resistance to misinformation and extremist propaganda.

Some limitations of the study must be recognised before considering its implications.

First, the study did not measure the duration of the inoculation effect. Future studies should test the effects of inoculation over time; this is particularly important because inoculation treatments in other contexts are known to decay over time.

Second, the study did not investigate whether inoculation is superior to fact-checking or corrections. It is conceivable that a correction after exposure to the target video could have achieved a similar reduction in acceptance and sharing intentions and so on. Future research should compare the benefits of inoculation to other approaches of combating misinformation.

Third, critics might argue that the observed effect sizes were too small to have much practical impact. In response, we suggest that even small effects can have major repercussions if they are scaled up to the population at large.

Notwithstanding the above caveats, the results provide support for the use of inoculation in combating extremist messages and demonstrate the potential success of using inoculation to make people more resilient to extremist disinformation. The inoculation findings are equally relevant to combating Islamophobia and Islamist extremism and provide an alternative approach to more conventional counter-messaging campaigns.

In the present study, the training video did not mention Islam or any issues related to Islam or radicalisation. The video nonetheless successfully inoculated people against being misled by two diametrically opposed radicalising positions. It follows that inoculation messages may be effective without the problems that may beset some other counter-messaging programs: neither lack of domain knowledge nor stigmatisation are likely to derail inoculation.

Future research should test the effectiveness of inoculation on groups who are likely targets of extremists. Whereas our approach was generic and broad-based, this may be insufficient to reach and protect at-risk populations such as adolescents who are known to heavily rely on social media and are likely to be exposed to radical content. Potentially, inoculation could give adolescents the tools to identify extremist messages and subsequently increase their resistance to persuasive misinformation.

Assuming that replications of this work are successful, avenues might be explored to roll out inoculation at scale. One potential avenue would involve YouTube itself, ideally by linking the inoculation material into the recommender system such that it is recommended to people who are likely to watch potentially radicalising content. At a time when regulation of social media is increasingly being entertained by policymakers, this rollout would constitute a response that does not incur the accusation of undue censorship.

INOCULATING AGAINST THE SPREAD OF ISLAMOPHOBIC AND RADICAL-ISLAMIST DISINFORMATION

Misinformation has taken centre stage in current political discussion. Misinformation refers to information that is either false or inaccurate. When misinformation is spread intentionally, for example in pursuit of a political agenda, we refer to it as disinformation. The potential dangers of misinformation and disinformation are well established. For example, misinformation about the link between vaccines and autism has led many people in the US refusing to vaccinate their children, thereby putting them at risk (Smith, Ellenberg, Bell, & Rubin, 2008).

At the same time, radicalisation and extremism are also growing global concerns. In a mutually reinforcing cycle known as reciprocal radicalisation (e.g. Abbas, 2012, 2020; Abbas & Awan, 2015; Lee & Knott, 2020), Islamophobia and radical Islamist views have gained prominence, sometimes resulting in extreme violence. In 2011, a right-wing extremist murdered 77 young people in Norway whom he presumed to be traitors conspiring to turn Norway into an Islamic society. In 2016, a jihadist extremist murdered 86 people in Nice, France, in retaliation against nations fighting the 'Islamic State' in Syria and Iraq.

Disinformation and propaganda are at the core of radicalisation (e.g. Baugut & Neumann, 2019; Johnson, 2018). Islamophobic portrayals in right-wing media facilitate Islamophobia (Bleich, Stonebraker, Nisar, & Abdelhamid, 2015). Mentions of Islam in the press are more negative than mentions of other religious groups (Jaspal & Cinnirella, 2010). Similarly, right-wing media outlets consistently associate Islam with issues such as forced marriage and terrorism (Moore, Mason, & Lewis, 2008). Violent incidents involving Muslim perpetrators are readily labelled as 'terrorism' whereas equivalent acts by White perpetrators are labelled differently (see, e.g. Dolliver & Kearns, 2019). This pattern of coverage may explain negative public attitudes towards Islam. For example, 41% of US adults believe that Islam encourages violence more than other faiths, and 35% of these individuals believed that there was widespread extremism amongst US Muslims (Pew Research Center, 2017). These public opinions are in contrast to research indicating that 95% of Muslims believe 'extremism and violence are never justified' (Ahmed & George, 2017; Pew Research Center, 2017).

The recognition of the importance of disinformation and propaganda in radicalisation is not novel and applies equally to Islamist radicalisation (e.g. Baugut & Neumann, 2019). Radical-Islamist groups use the internet to spread propaganda and seek recruits (Conway, 2017). For example, Islamic State claimed to be responsible for the 2017 mass shootings in Las Vegas; however, the FBI has since rejected these claims (Says, 2019). Islamic State likely used this false claim to spread fear and to radicalise individuals towards taking similar action. These activities affect search engines. For example, the benign religious term 'Mujahideen' (which became common when describing soldiers from Afghanistan who fought against the British in the 19th Century; Farwell, 1985) returns radical-Islamist content on the second page of Google search results (Ahmed & George, 2017).

In response to Islamist misinformation, the US government has made repeated attempts to counter radicalisation and jihadist-inspired terrorism by debunking misinformation and propaganda with a 'Counter-Misinformation Team.' However, those efforts have not only been unsuccessful but may have been counterproductive (Aistrope, 2016). In part, this failure arose from a delegitimising dynamic in the American discourse that undermined the intent to engage with a Muslim audience and instead caused further alienation (Aistrope, 2016).

Although those specific errors might be avoidable by better design, in principle any persuasive effort or attempt to counter misinformation carries with it a risk of failure. There is evidence that the effectiveness of misinformation correction is mixed and often

remains incomplete (Lewandowsky, Ecker, Seifert, Schwarz, & Cook, 2012; Walter & Murphy, 2018).

The risks associated with countering misinformation may be avoided by interventions based on 'inoculation theory' (Cook, Lewandowsky, & Ecker, 2017; van der Linden, Maibach, Cook, Leiserowitz, & Lewandowsky, 2017). Inoculation equips individuals with the ability to critically assess and refute misinformation by revealing the flaws in misleading communications before exposure (Cook et al., 2017).

Inoculation involves two components (van der Linden, Leiserowitz, Rosenthal, & Maibach, 2017). The first component is a reminder that politically motivated groups often distort or manipulate information in pursuit of their agenda. The second component explains the logical fallacies typically embedded in misinformation and provides a pre-emptive refutation (Roozenbeek & Linden, 2019).

Existing research has demonstrated that inoculation can protect the public againstflawed contrarian argumentation about climate change and misinformation in general (Cook et al., 2017; Roozenbeek19; van der Linden et al., 2017). In one study, inoculation was also found to create resistance to extremist propaganda (Braddock, 2019). Participants in that study were shown either an inoculation message or no-inoculation control message before reading left- or right-wing extremist propaganda. Inoculation reduced support for the extremist groups. The findings reported by Braddock suggest that inoculation may be a suitable tool to protect individuals against Islam-related extremism as well, which is the focus of the current study.

To our knowledge, inoculation has not been applied to Islamophobic and Radical-Islamist disinformation before. We focused our intervention on YouTube. YouTube boasts over two billion users, making it the second most visited website worldwide. At the heart of YouTube's architecture is a recommender system that is designed to maximise viewing time on the platform (Covington, Adams, & Sargin, 2016). Each video on YouTube is accompanied by recommendations for further viewing in a sidebar.

These recommendations are created by 'intelligent' algorithms based on the user's activity and the interconnectedness of videos. YouTube recommender algorithms have been repeatedly criticised for facilitating pathways to radicalising content (Schmitt, Rieger, Rutkowski, & Ernst, 2018; Spinelli & Crovella, 2020). For example, users who viewed videos of Donald Trump during the 2016 presidential campaign were subsequently presented with videos featuring white supremacists and Holocaust denialists. After playing videos of Bernie Sanders, YouTube suggested videos relating to left-wing conspiracies, such as the claim that the US government was behind the September 11 attacks (Tufekci, 2018). A recent preregistered study of the YouTube recommender system confirmed that it was liable to promote and amplify conspiratorial content even in response to relatively innocuous search terms (Alfano, Fard, Carter, Clutton, & Klein, 2020).

A particularly troubling aspect of the algorithm is that it has difficulty differentiating between radical content and other messages. For example, radical content can appear in the recommender tab of far-right counter-messages. That is, deradicalisation messages on YouTube may be accompanied by recommendations to precisely the opposite (Schmitt et al., 2018). Moreover, an audit of pathways towards radicalisation identified pathways between alt-lite (a loosely defined right-wing group who see themselves separate from the far-right) videos and the intellectual dark web (a group of political commentators who regard identity politics and political correctness as a danger to society). The analysis also uncovered pathways between alt-right channels (white nationalist movements) and Intellectual dark web videos (Ribeiro, Ottoni, West, Almeida, & Meira, 2020). Overall, there is sufficient evidence to warrant concern about YouTube's role in directing viewers to radical or extremist content.

METHOD

In preparation for the current study, we analysed Islamophobic and radical-Islamist videos on YouTube using the YTDT tool (Rieder, 2015) to understand the techniques by which extremists mislead (this analysis is reported in the *Appendix*). The present study used these rhetorical markers of misinformation to create inoculating tools that can protect vulnerable people against misinformation and potential Islamophobic and Islamist radicalisation.

ETHICS, PREREGISTRATION, AND DATA AVAILABILITY

All aspects of the research received ethics approval from two independent bodies: The Psychological Science School Research Ethics Committee at the University of Bristol and the CREST Security Research Ethics Committee at Lancaster University. The ethics process examined all stimuli used in the study, in addition to recruitment and debriefing procedures. Given the nature of the material, particular care was taken to ensure that participants were debriefed (see details below).

The Method and analysis plan were preregistered. The preregistration is available at *https://osf.io/au9wh/*. The data set with potentially identifying information removed and all analysis scripts and Markdown files are available at *https://osf.io/4eh3x/*.

PARTICIPANTS

The number of required participants was calculated using the software G*power using $\alpha = 0.05$, $f = 0.15$, resulting in a total required sample size of 580. Participants were recruited through the online platform Prolific and were paid £3.15 for the 30-minute session.

All participants resided in the UK at the time of participating. To compensate for dropouts before completion, a total of 641 participants were recruited by Prolific, which yielded a final sample size of 591 participants (368 females, 218 males, 3 non-binary, and 1 withheld response).

The average age of participants was 35.50 (SD = 12.40). 4.2% of participants were Muslim, 33.2% were Christian, 36.4% were Atheist, 14.4% were Agnostic, 9% were Other, 1.4% were Hindu, 0.5% were Jewish, 0.3% were Sikh, and 0.7% were Buddhist.

DESIGN

The study used a 2 × 2 between-subjects design with variables training (no intervention vs. inoculation) and misinformation (Islamophobic Misinformation vs. radical-Islamist misinformation). Participants were randomly allocated to one of the 4 groups (see *Table 1* for the number of participants per group). Dependent variables were perceived accuracy of the target video, feelings of anger, likelihood to share the target video, extent of agreement and extent of support for the target video, and next-video preference (expressed by choosing another video from a 'recommender system').

PROCEDURE

Figure 1 provides an overview of the procedure. Participants first answered demographic questions, including about their religious orientation. Participants then either watched the training material (inoculation condition; see below for details) or content about an unrelated issue (control condition). The control condition video taught participants about the use of bitcoin and the origin of money and was the same length as the inoculation video. Participants then watched the target video, which depending on random assignment either displayed content comprising a conduit to radical-Islamist content or Islamophobic content.

All participants were then presented with a mock YouTube sidebar with a recommender tab of five videos (see *Figure 2*) that, depending on condition, displayed Islamophobic or radical-Islamist video titles. The titles and thumbnails were arranged on an ordinal scale of extremism, from benign content to extreme content. Participants were asked to select from the recommender tab what video they would like to watch next.

Following their next-video selection, participants responded to questions about the target video. All questions used a 5-point Likert scale, except for agreement, which used a 6-point scale. The first question investigated the participants' likelihood of sharing the video via social media platforms (response options ranging from highly unlikely to highly likely). The second question inquired about the extent to which participants believed the video to be reliable (response options ranging from highly unreliable to highly reliable). The third question aimed to determine participants' level of anger after watching the video (response options ranging from none at all to a great deal). The fourth question queried the extent to which participants agreed with the video (response options ranging from 'I accepted all of the points made in the message' to 'I argued against all of the points made in the message'). The fifth and final question aimed to determine the participants' level of support for the ideas presented in the video. Instead of a 5-point scale, this question used a slider from 0–100. The slider was positioned at 0 at the outset.

Participants were then asked to watch a debrief video and read a debrief sheet. The debrief video consisted of the inoculation video and a video explaining the push and pull factors involved in radicalisation. Participants who did not watch the debrief video were sent an invitation to complete the study by watching the debrief video. Fifteen participants were sent an invitation to watch the debriefing video. Thirteen of these participants completed the debrief upon receiving the invitation. Data from participants who did not watch the debrief video during the experiment were included, irrespective of whether or not they subsequently followed the invitation.

MATERIALS

TRAINING VIDEO

The training video for the inoculation condition was designed to counter the prevailing misleading rhetorical techniques identified by our analysis of extremist YouTube videos (see *Supplements*: S1 for details). The analysis identified hasty generalisations, invoking emotion, and polarisation as common markers of Islam-related misinformation. Polarisation refers to the process of amplifying existing differences and tensions between different groups of people (Groenendyk, 2018). Hasty generalisations involve individuals jumping to conclusions based on incorrect induction and flawed statistical reasoning (Walton 2008, pp. 246–247). Invoking emotion is a persuasive technique in which individuals appeal to human emotions such as fear, anger, or empathy (e.g. Das, Wit, & Stroebe, 2003). The training video used a series of narrated animations to explain how each misinformation technique is used to mislead. The video did not mention Islam or any related issues but used hypothetical and generic examples from politics to explain the techniques. The training video is available at *https://vimeo.com/439769758/cf388de426*

TARGET VIDEOS

The Islamophobic and radical-Islamist videos were designed by harvesting background video ('B-roll') from Islam-related videos on YouTube. The scripts for the target videos used the three misleading techniques (hasty generalisation, polarisation and invoking emotion) in order. The scripts are available in the online supplement (See *Supplements*: S2 to read the scripts).

To ensure comparability of scripts between the target vides, they were analysed using the Linguistic Inquiry and Word Count (LIWC) program (Pennebaker, Boyd, Jordan, & Blackburn, 2015). The LIWC software analyses text and counts the percentage of words that reflect different emotions, thinking styles, social concerns, and parts of speech.

As shown in *Table 2*, the texts were similar in the word count for each rhetorical misinformation technique (hasty generalisations, invoking emotion, polarisation) and in terms of the percentage of social words, positive words, and negative words used. The table also shows that the scripts used less negative emotion words and more positive emotion words compared to actual extremist content obtained from YouTube. The scripts also contain more negative and positive emotion words in comparison to neutral informational videos about Islam, also obtained from YouTube (links to these videos are provided in the table). A small pilot study on five participants was conducted to check if the scripts produced strong negative emotions. The scripts did not evoke emotional distress, anger, desire to harm others, or overall negative emotions.

RESULTS

Figure 3 provides an overview of the results for the main dependent variables. In accordance with the preregistered analysis plan (see *https://osf.io/au9wh*), 2 × 2 ANOVAs were used to test the effects of training condition and type of misinformation on the dependent variables (sharing likelihood, perceived reliability, anger, agreement, and support for the video).

SHARING LIKELIHOOD

There was a significant main effect of training condition on sharing likelihood, F (1, 587) = 5.97, MSE = 0.96, p = .015, $\eta^{\wedge 2}_{G}$ = .010. Participants in the inoculation condition were less likely to share the misinformation content than participants in the control condition (M = 1.44 vs M = 1.64). There was no main effect of type of misinformation, F (1, 587) = 0.00, MSE = 0.96, p = .954, $\eta^{\wedge 2}_{G}$ = .000, nor an interaction effect between training and misinformation, F (1, 587) = 0.14, MSE = 0.96, p = .708, $\eta^{\wedge 2}_{G}$ = .000.

PERCEIVED RELIABILITY

There were main effects of training condition, F (1, 586) = 14.11, MSE = 1.29, p < .001, $\eta^{\wedge 2}_{G}$ = .024, and type of misinformation, F (1, 586) = 8.10, MSE = 1.29, p = .005, $\eta^{\wedge 2}_{G}$ = .014, on perceived reliability. Participants in the inoculation condition perceived the misinformation content as less reliable than participants in the control group (M= 1.95 vs. M = 2.30). Participants who saw Islamophobic misinformation rated the content as less reliable than participants who saw radical-Islamist misinformation (M= 2.26 vs. M = 2.00). There was no interaction between the two experimental variables, F (1, 586) = 0.04, MSE = 1.29, p = .846, $\eta^{\wedge 2}_{G}$ = .000.

ANGER

There was a significant main effect of misinformation on participants' feeling of anger, F (1, 586) = 8.02, MSE = 1.38, p = .005, $\eta^{\wedge}$ = .013. Participants who watched Islamophobic content reported greater feelings of anger than participants who watched radical-Islamist content (M = 2.35 vs. M = 2.62). There was no main effect of training condition, F (1, 586) = 0.08, MSE = 1.38, p = .777, $\eta^{\wedge 2}_{G}$ = .000, nor an interaction between the two experimental variables, F (1, 586) = 1.56, MSE = 1.38, p = .213, $\eta^{\wedge 2}_{G}$ = .003.

AGREEMENT

The main effects of training condition, F (1, 587) = 5.58, MSE = 1.62, p = .019, $\eta^{\wedge 2}_{G}$ = .009, and type of misinformation, F (1, 587) = 7.23, MSE = 1.62, p = .007, $\eta^{\wedge 2}_{G}$ = .012, were both significant. Participants who received inoculation agreed less with the misinformation content than participants in the control group (M = 2.67 vs. M = 2.92). Participants who watched the Islamophobic content agreed less with the points made in the video than participants who watched the radical-Islamist content (M = 2.93 vs. M = 2.65). There was no interaction between the two experimental variables, F (1, 587) = 0.23, MSE = 1.62, p = .631, $\eta^{\wedge 2}_{G}$ = .000.

SUPPORT FOR THE VIDEO

Unlike the other measures, the survey software recorded a notable number of missing responses for this measure. This likely reflected the fact that for this question, a slider was used, with the original position of the slider at zero. Thus, if a participant wanted to report zero support, they would have had to log a click on the slider and then move it back to zero. It is possible that some participants were not aware of this and proceeded to the next question without moving the slider, which was recorded as a missing response.

There was a main effect of training condition, F (1, 534) = 3.49, MSE = 637.38, p = .062, $\eta^{\wedge 2}_{G}$ = .006. Participants in the inoculation condition indicated less support than participants in the control group (M = 21.48 vs. M = 25.55). There was no main effect of type of misinformation, F (1, 534) = 2.24, MSE = 637.38, p = .135, $\eta^{\wedge 2}_{G}$ = .004, nor an interaction between both

variables, F (1, 534) = 0.00, MSE = 637.38, p = .959, η^{2}_{G} = .000, on participants' level of support.

NEXT-VIDEO RESPONSE

We next analysed responses to the 'recommender system' tab (*Figure 2*). None of the effects was significant. There was no main effect of training condition, F (1, 587) = 0.16, MSE = 1.37, p = .686, η^{2}_{G} = .000, type of misinformation, F (1, 587) = 0.27, MSE = 1.37, p = .606, η^{2}_{G} = .000, and there was no interaction, F (1, 587) = 0.01, MSE = 1.37, p = .908, η^{2}_{G} = .000. One reason for this outcome might be that the videos offered in the recommender system tab did not have the intended clear ordinal relationship from lowest to highest extremity.

EXPLORATION OF ANGER AND AGREEMENT

We conducted an additional exploratory analysis (not pre-registered) that examined the association between self-reported anger and agreement with the target video. *Figure 4* displays the results, broken down by condition.

One might expect that low agreement with the video might be associated with greater anger. The figure shows that this association was indeed observed, to varying extents, in all conditions. Perhaps unexpectedly, anger was also greater when agreement was greatest, in 3 out of 4 of the conditions. A possible reason might be that anger is directed differently in the two situations: When agreement is low, anger might be directed at the content of the video, whereas if agreement is high, anger might be directed at the groups targeted *by* the video. This account is intriguing but speculative and we do not pursue it further.

DISCUSSION

LIMITATIONS AND RELATIONSHIP TO PREVIOUS RESULTS

Several limitations of the study must be recognised before we consider its implications.

First, the study did not measure the duration of the inoculation effect. Future studies should test the effects of inoculation over time; this is particularly important because inoculation treatments in other contexts are known to decay over time (Banas & Rains, 2010).

Second, the study did not investigate whether inoculation is superior to fact-checking or corrections. It is conceivable that a correction after exposure to the target video could have achieved a similar reduction in acceptance and sharing intentions, and so on. Future research should compare the benefits of inoculation to other approaches of combatting misinformation.

Third, critics might argue that our observed effect sizes were too small to have much practical impact. In response, we suggest that even small effects can have major repercussions if they are scaled up to the population at large. President Trump won the election in 2016 by a razor-thin margin in a few key states, equivalent in number to the capacity of a single football stadium, or .0009 of all votes cast (Meko, Lu, & Gamio, n.d.). Clearly, even a very small intervention could have swung the outcome of the election. Other recent results support this contention. For example, Pennycook, McPhetres, Zhang, Lu, and Rand (2020) showed that providing a simple accuracy reminder nearly tripled people's truth discernment of headlines relating to COVID-19.

Notwithstanding these limitations, our study lends further support to the use of inoculation in combatting extremist messages. Although much is known about the effectiveness of inoculation against general misinformation (Cook et al., 2017; Roozenbeek & Linden, 2019; Roozenbeek, Linden, & Nygren, 2020; van der Linden et al., 2017), the evidence base relating to extremism is scarce. In addition to the study by Braddock (2019) mentioned earlier, we know of only one further study (Saleh, Roozenbeek, Makki, McClanahan, & van der Linden, 2020). This recent study inoculated participants through an 'active' manipulation, by inviting participants to play a game in which they pretended to be a recruiter for a fictitious terrorist group. This role-playing exercise was found to increase participants' ability to detect manipulative messages. Although these results are promising, one limitation of the game approach (see also, Roozenbeek & Linden, 2019; Roozenbeek et al., 2020) is that the time involvement (15 minutes) is higher than in other inoculation contexts, including our study.

PRACTICAL IMPLICATIONS

Some interventions against violent extremism and radicalisation have not relied on empirical evidence to inform best practice. For example, the US government program 'Think Again, Turn Away' argued against Islamic State propaganda on social media. The program was unsuccessful and was eventually terminated. Critics argued that the program was beset with incompetence and lack of knowledge about the arguments it became involved in on Twitter (Katz, 2014). In the UK, the government's Prevent strategy, designed to stop people from becoming terrorists or supporting terrorism, has been subject to extensive, and sometimes withering, criticism (Awan, 2012; Qureshi, 2015; Richards, 2011; Thomas, 2010). Much of that criticism focused on the perceived stigmatisation of the Muslim community.

These kinds of problems can be avoided in the inoculation framework because the material can be relatively generic. In the present study, the training video did not mention Islam or any issues related to Islam or radicalisation. The video nonetheless successfully inoculated people against being misled by two diametrically opposed radicalising positions. It follows that inoculation messages can be effective without the problems that beset other programs: neither lack of domain knowledge nor stigmatisation are likely to derail inoculation.

Future research should test the effectiveness of inoculation on groups who are likely targets of extremists. Whereas our approach was generic and broad-based, this may be insufficient to reach and protect at-risk populations. For example, adolescents rely on social media which increases the risk of exposure to propaganda (Baugut & Neumann, 2019). An investigation in Germany reported that more than one third (37%) of participants aged 14–19 years had been exposed to radical content (Nienierza, Reinemann, Fawzi, Riesmeyer, & Neumann, 2019). Inoculation could give adolescents the tools to identify extremist messages and subsequently increase their resistance to persuasive misinformation.

Assuming that those replications are successful, avenues must be explored to roll out inoculation at scale. One potential avenue would involve YouTube itself, ideally by linking the inoculation material into the recommender system such that it is recommended to people who are likely to watch potentially radicalising content. At a time when regulation of social media is increasingly being entertained by policymakers, this rollout would constitute a response that does not incur the risk of censorship.

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APPENDIX

TABLE 1

Number of Participants Per Group.

	Type of Misinformation	
	Islamophobic	Islamist
Training condition Inoculation	145	149
Control	151	146

TABLE 2

LIWC analysis of training videos and extremist videos on YouTube.

Measure	Islamophobic	Islamist	Youtube	Youtube	Youtube	Youtube
	script	script	Islamo- phobic (a)	Islamist (b)	neutral Islamophobic (c)	neutral Islamist (d)
Hasty Generalisations word count	175.0	174.0				
Invoking Emotion word count	194.0	197.0				
Polarisation word count	169.0	168.0				
I words (I, me, my) (%)	0.2	0.2	1.0	2.9	0.7	0.0
Social Words (%)	8.2	7.8	14.6	15.6	7.8	9.1
Positive Emotions (%)	3.9	3.8	2.0	1.3	1.6	2.3
Negative Emtoions (%)	1.7	1.7	5.3	2.6	0.0	1.4

[a] https://youtu.be/8T9JJi6kqrc

[b] removed from YouTube

[c] https://youtu.be/glAI5YMMw0Y

[d] https://youtu.be/sjJVO8GASmw

FIGURE 1

Overview of procedure

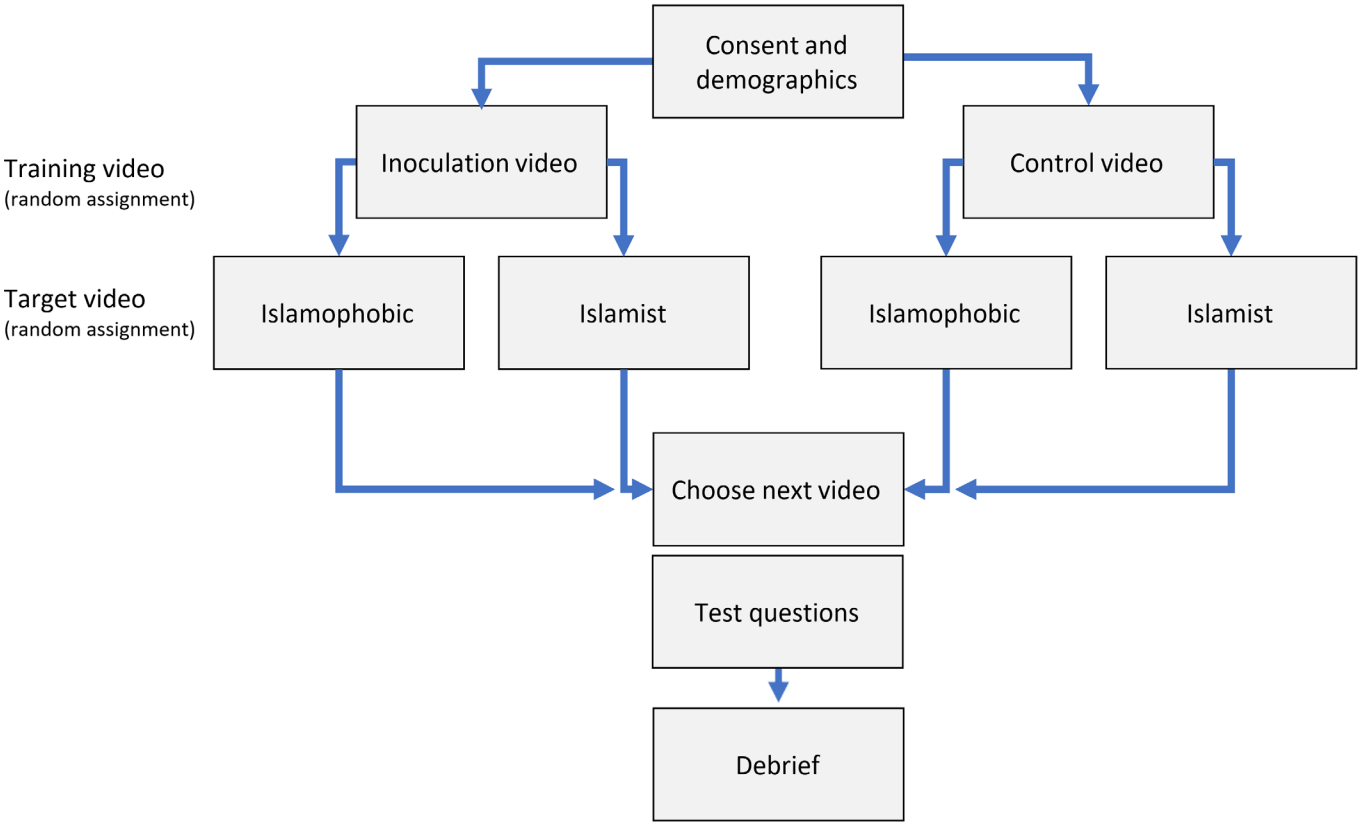
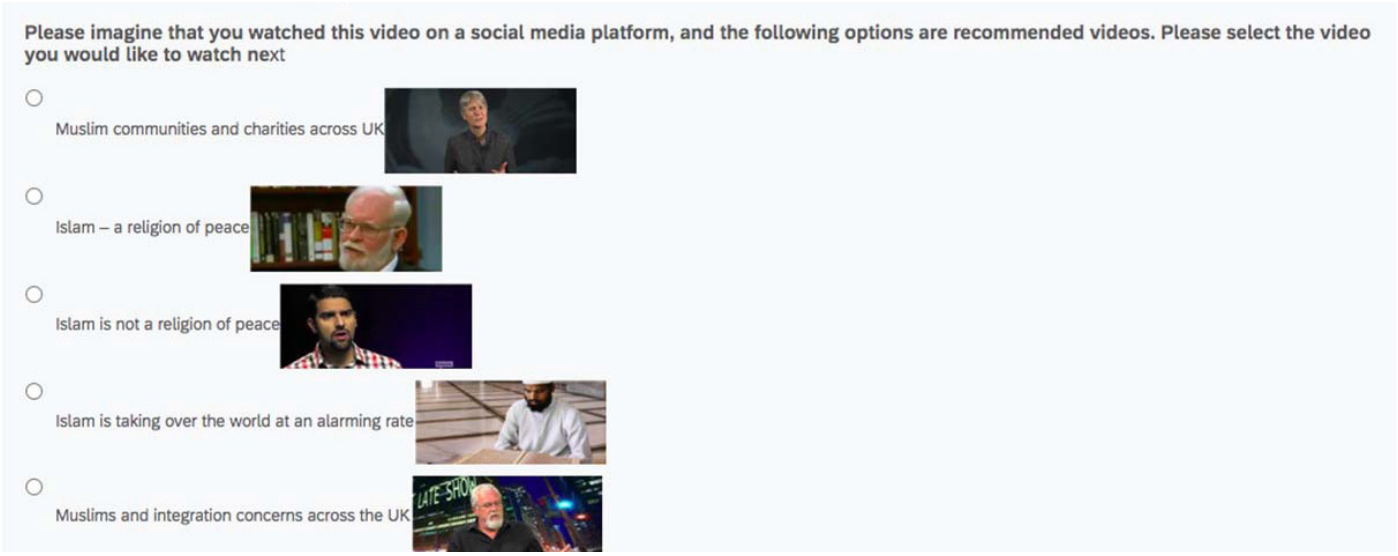


FIGURE 2

Screenshot of the recommender tabs for the two conditions.

Islamophobic recommender tab



Islamist recommender tab

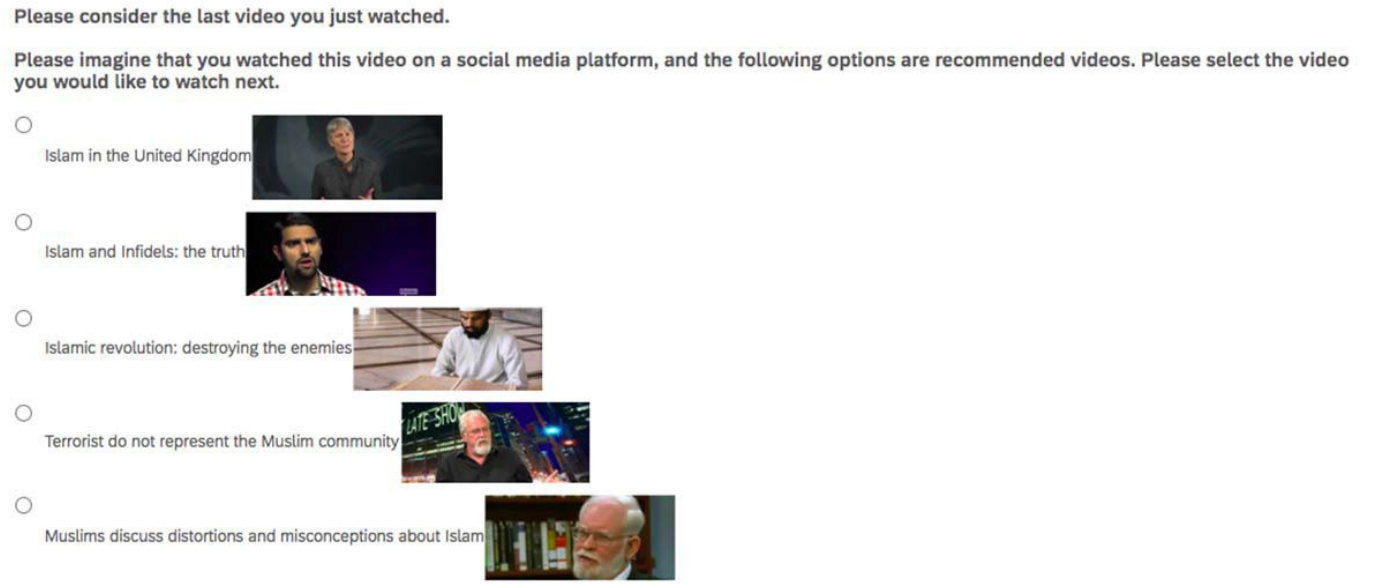


FIGURE 3

Summary of the main dependent variables for all conditions. The top panel is for the Islamist target video and the bottom panel for the Islamophobic target video. All dependent variables are rescaled to the range 0 to 1 for commensurability. Error bars represent 95% confidence intervals.

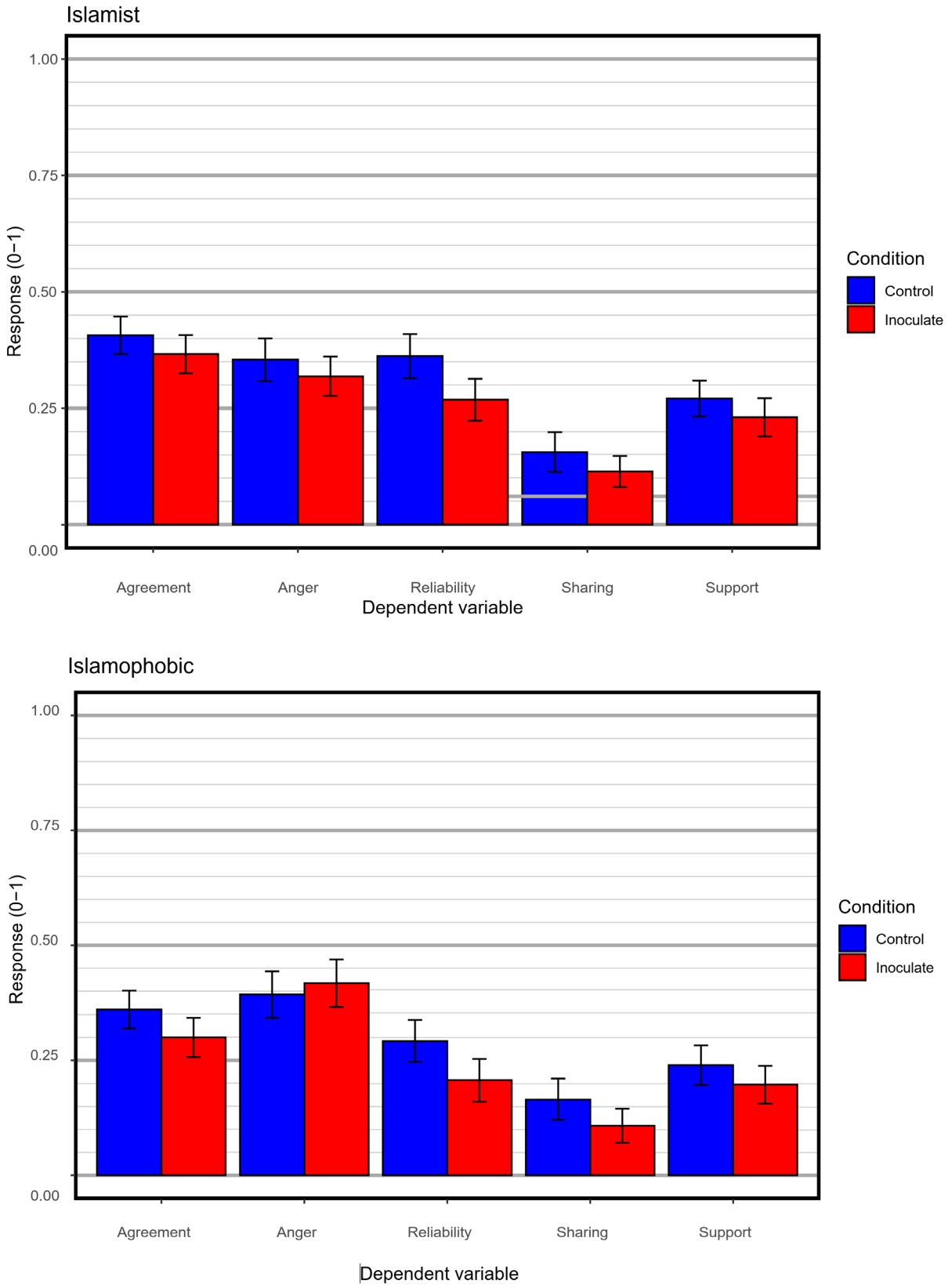
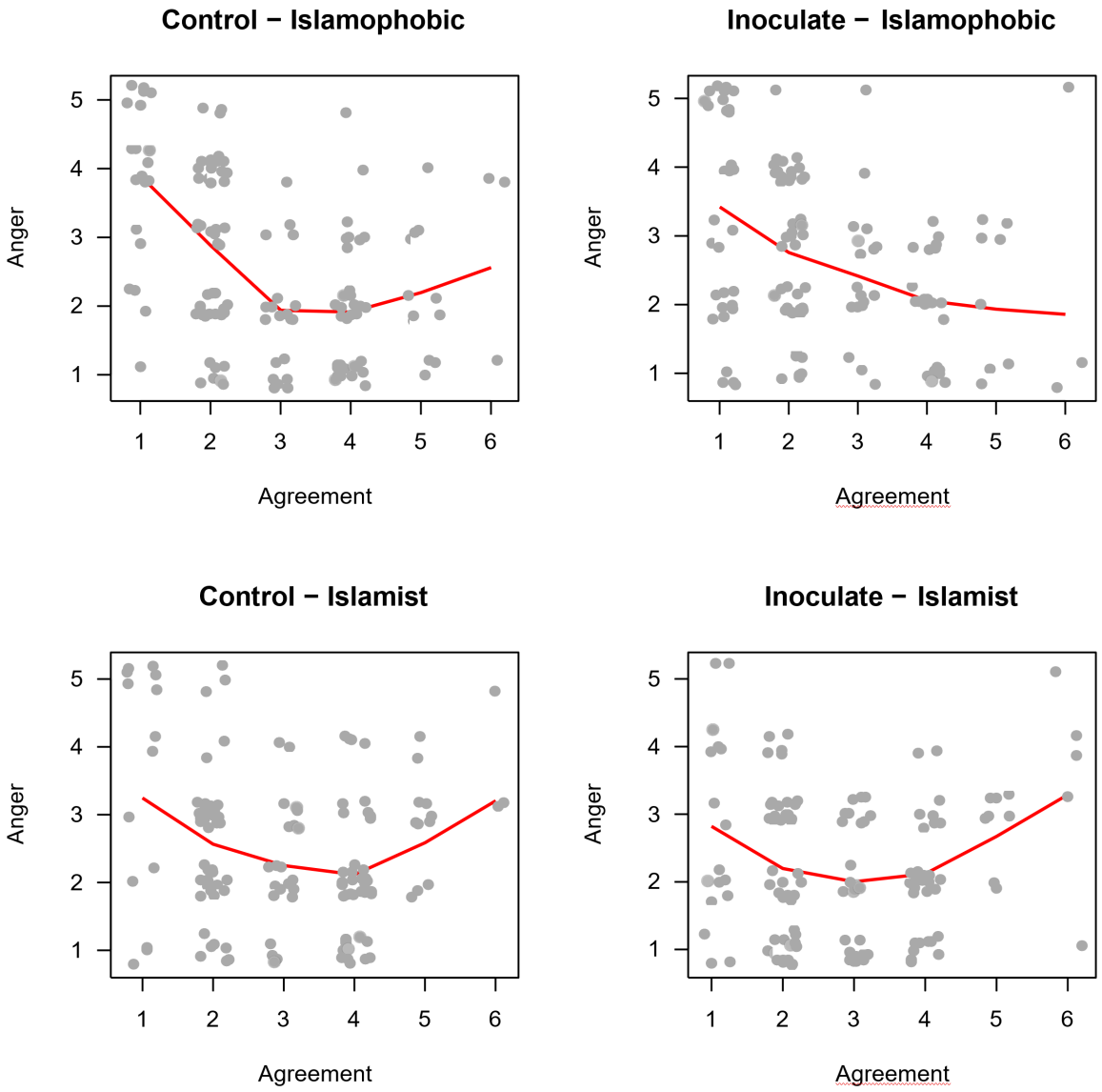


FIGURE 4

Relationship between anger and agreement with the video in the 4 conditions. All points are jittered to avoid overprinting. The red lines represent lowess smoothing.



SUPPLEMENTS

SECTION S1: EXAMINING THE YOUTUBE LANDSCAPE IN RELATION TO ISLAM-RELATED EXTREMISM

We aimed to explore the recommender system on YouTube to illustrate representative paths that users might take to make contact with extremist disinformation. The analysis considered the role of benign, apolitical, and non-violent search terms, and how they can lead to extremist content and disinformation after a few clicks. The study also explored paths to radical content from search terms that are likely to elicit anti-Islam and pro-Jihadi propaganda content, respectively.

DATA COLLECTION

We identified four search keys to build Islamophobic and radical-Islamist networks, respectively (see *Table S1* for the search keys). The analysis selected two overtly pro-jihadi and Islamophobic search items (identified with a double asterisk in the table) and two benign, apolitical search keys (single asterisk).

The search keys associated with radical-Islamist content were derived from a study that analysed the Google search queries that returned problematic content (Ahmed & George, 2017). The search keys associated with Islamophobic content were derived from text analysis of Islamophobia on Twitter (Evolvi, 2018).

The online tool YTDT Video Network was used to build a list of related videos – that is, those recommended by the recommender system – from the search keys (Rieder, 2015).

The tool retrieved related videos for each search key together with their metadata (e.g. video ID, video title, URL) from YouTube's application programming interface (API).

Resources are first sorted based on their relevance, then in reversed chronological order based on the date they were created, their rating (highest to lowest), title (alphabetically) and view count (highest to lowest number of view counts).

YTDT provides information about the related videos in the form of nodes (videos) and edges (a connection via the recommender system between two nodes) The related videos were collected with a crawl depth = 1. Crawl depth specifies how far from the initial search key the script should go. Crawl depth = 0 retrieves the relations between the videos returned from the search keys. The iterations were sent to 1 which returns 50 videos for each search key at crawl depth = 0. Crawl depth = 1 determines the relation between the videos returned from each of the search key and their directly-related videos (videos recommended from the first set).

PROCEDURE

The related videos derived from the search YTDT search were used to build two visual networks using the Gephi software (https://gephi.org/) with the 'ForceAtlas2' algorithm, for Islamophobic and radical-Islamist content, respectively. A modularity analysis then identified distinct communities (i.e. clusters of highly related videos). Videos in the network (nodes) were assigned a betweenness centrality value. Betweenness centrality is a measure of how often a node appeared on the shortest path between two nodes and thus is an indicator of the importance of that node to the network as a whole.

The top 30% of videos (ranked by betweenness centrality) in each community, were categorised by their content (e.g. blogging, gaming, Islamophobic content, radical Islamist content etc.) for both of the respective networks.

A content analysis was then conducted by the second author on the top 50 videos (ranked by betweenness centrality) that were categorised as Islamophobic. A parallel content analysis was conducted on the top 26 videos (ranked by betweenness centrality) that were categorised as potentially radical-Islamist. Only 26

videos were analysed in the radical-Islamist network because it contained only a small number of videos.

Based on previous work (e.g. Roozenbeek & Linden, 2019) augmented by our conceptual analysis, the content analysis targeted the following techniques associated with the production of misinformation: polarisation, invoking emotions, spreading conspiracy theories, trolling people online, deflecting blame, and impersonating fake accounts, misrepresentations of scripture, and cherry-picked data. The analysis also aimed to identify examples of common right-wing populist fallacies, based on prior work by Blassnig, Büchel, Ernst, and Engesser (2019): Ad consequentiam, Ad hominem, Ad populum, and hasty generalisations.

RESULTS

Network structure. *Figure S1* shows the networks for Islamophobia (on the left) and Islamism (right). The Islamophobia network comprised 8,972 nodes (videos) and 211,410 edges. The total number of communities in this network was 21, with a modularity value of 0.550, indicating medium to high distinctiveness between the communities. Communities 0, 10, and 6 comprised a large proportion of the nodes in the network; see legend in *Figure S1* for a summary of the top 8 community sizes. Descriptive labels for the communities (based on content analysis) are shown in *Table S2*. The Islamist network comprised 11,367 nodes and 211,410 edges with 32 communities, with a modularity value of 0.610, indicating high distinctiveness between the communities. Communities 7, 29, and 28 comprised a large proportion of the nodes in the network (see legend). Descriptive labels for the communities are shown in *Table S3*.

Content analysis. For Islamophobia, a content analysis of the top 30% of videos in each community, as measured by betweenness centrality, indicated that 13.45% of videos contained Islamophobic content. Communities 0, 10, and 6 contained the largest proportions of Islamophobic content; see *Table S2* for a summary. For Islamist videos, the content analysis of the top 30% of videos in each community, as measured by betweenness centrality, indicated that 0.93% of the videos contained radical-Islamist content. Communities 3, 5, 6, 10 contained the largest proportions of radical-Islamist content in the network (*Table S3*).

Misinformation techniques. *Figure S2* compares the number of occurrences of the specific misinformation techniques targeted by the content analysis between the two types of videos. Some key differences between the networks are apparent: The Islamist videos exhibited more frequent use of misrepresentation of scripture, invoking emotion, and spreading conspiracies in comparison to the Islamophobic network. The Islamophobic network exhibited more frequent use of cherry-picked data in comparison to the Islamist network.

SECTION S2: ISLAMOPHOBIC AND RADICAL-ISLAMIST SCRIPTS OF THE TARGET VIDEOS

The scripts below were designed to use the misinformation techniques being explained in the training video. The text is split into three techniques; Polarisation, Hasty Generalisations, and Invoking Emotion.

ISLAMOPHOBIC CONTENT

SCRIPT
Islam in society: A change is needed

Polarisation

There is a definite problem with radical Islam in this country; altering our Western democratic way of life. I mean whether we like it or not, and we can be very politically correct, but whether we like it or not, there is a situation. Islamic values are not in line with Western values. To come up with a resolution; we have to be to be able to talk about the problem, or at least acknowledge that Islamic culture does not accommodate Western culture. The recent events that have transpired have made it clear that we are under attack by Islam. This is clearly important. The current state of Islam is transforming the Western way of life. Parents have to change their behaviours as a means of raising their children up traditionally, without Islamic influence. This is one of the greatest things that change can offer us; an education system, media,

and an environment that supports Western values. The differences between the two groups are obvious and divide is needed.

Hasty Generalisations

The wealth imbalance, the mass poverty that is spread all over the country; is a product of accommodating Muslims at the expense of Western values. We have all heard about the decline in living standards, and housing across the country; and Muslim migration is at the root of the difference. It is clear that without Muslim migration, this mass poverty could be resolved.

For too long people have been deprived freedom of speech and the protests against Muslims have made it very clear that Islam is not welcomed in this country. Therefore, it is reasonable to propose the idea of moving away from the influence of Islam in this country. It is reasonable to suggest that such an idea will bring back our freedom and prosperity. Islam is not working for its people and only Westernisation can protect the people. The country has been through a challenging time and it has happened at the same time as the rise of Islam. Therefore, only Western values can put us back on track.

Invoking Emotion

Take the recent events as a prime example. Fifteen people were wounded in a recent radical Islamic attack that has changed the lives of the individuals forever. Muslims who knew the perpetrator did not report the attack. If they did, they could have stopped the situation from occurring. It is now a reality for the victims; they will suffer because of a lack of action taken by the Islamic community. So it begs the question, how many examples do we put up with before we look for a solution?

This situation is global; these situations are happening around the world at a high rate, and consistently. Look at the global incidences being reported, and you will see that Muslims do not report. How many times have you preventable scenes due to Muslims not acting on the situations? Many countries have identified that Muslims do not care about Western values. And this fact could explain why there have been so many unreported situations, resulting in so many preventable events. We urge you to consider whether you are willing to accept these differences, or do you also crave direct action? Your opinion is very important, speak up.

RADICAL ISLAMIST CONTENT

SCRIPT
Islam in society: A change is needed

Polarisation

There is a definite problem with the Westernisation in this country; altering our Islamic spiritual way of life. I mean whether we like it or not, and we can be very politically correct, but whether we like it or not, there is a situation. Westernisation is not in line with Islamic values. To come up with a resolution; we have to be to be able to talk about the problem, or at least acknowledge that Westernisation does not accommodate Islamic culture. The recent events that have transpired have made it clear that we are under attack by Westernisation. This is clearly important.

The current state of Westernisation is transforming the Islamic way of life. Muslim parents have to change their behaviours as a means of raising their children up Islamically, without Westernisation. This is one of the greatest things that change can of us; education system, media, and an environment that supports Islamic values. The differences between the two groups are obvious and divide is needed.

Hasty Generalisations

The wealth imbalance, the mass poverty that is spread all over the country; is a product of accommodating Westernisation at the expense of Islam. We have all heard about the decline in living standards, and housing across the country; and capitalism is at the root of the difference. It is clear that without Westernisation, this mass poverty could be resolved.

For too long Muslims have been deprived freedom of speech and the protests against Muslims have made it very clear that Islam is not welcomed in this country. Therefore, it is reasonable to propose the idea of moving away from the influence of Westernisation in this country. It is reasonable to suggest that such an idea will bring back our freedom and prosperity. Westernisation is not working for its people and only Islam can protect the people. The country has been through a challenging time and it has happened at the

same time as the rise of Westernisation. Therefore, only Islamic values can put us back on track.

Invoking Emotion

Take the recent events as a prime example. Fifteen Muslims were wounded in a recent far-right extremist attack that has changed the lives of the individuals forever. Supporters who knew the perpetrator did not report the attack. If they did, they could have stopped the situation from occurring. It is now a reality for the victims; they will suffer because of a lack of action taken by the Western community. So it begs the question, how many examples do we put up with before we look for a solution?

This situation is global; these situations are happening around the world at a high rate, and consistently. Look at the global incidences being reported, and you will see that politicians do not report. How many times have you witnessed preventable scenes due to Westerners not acting on the situations? Many countries have identified that Westerners do not care about Islamic values. And this fact could explain why there have been so many unreported situations, resulting in so many preventable events. We urge you to consider whether you are willing to accept these differences, or do you also crave direct action? Your opinion is very important, speak up.

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TABLE S1

Search Items and videos

Risk of Radical-Islamist Content	Risk of Islamophobic Content
Caliphate *	Islam is the problem **
Killing infidels **	Muslim Migration *
No life without Jihad**	Islamic Grooming Gangs **
Sharia Law*	Islam United Kingdom

TABLE S2

Summary of Islamophobia network

Group	Group label	N total	N top 30%	N top 30% Islamo-phobic	% in top 30% Islamo-phobic
C0	IC – Migration Concerns	1604	481	45	9.4
C1	Documentaries	659	198	5	2.53
C2	News & Politics	833	250	9	3.6
C3	IC - Grooming Gangs	521	156	25	16
C4	IC – Migration Concerns	195	59	6	9.74
C5	IC – Violence Concerns	773	232	89	38.36
C6	IC – Grooming Gangs	1209	363	71	19.56
C7	IC – Migration Concerns	319	96	18	18.75
C8	-	-	-	-	-
C9	-	-	-	-	-
C10	IC – Diverse Content	1366	410	72	17.6
C11	Religion & Spirituality	93	28	1	3.7
C12	News & Politics	249	75	5	6.66

C13	Sports	57	17	0	0
C14	Finance	52	16	0	0
C15	Entertainment	107	32	0	0
C16	-	-	-	-	-
C17	Education	41	12	0	0
C18	Religion & Spirituality	85	26	0	0
C19	Entertainment	183	55	0	0
C20	People & Blogs	130	39	0	0

TABLE S3

Summary of Islamophobia network

Group	Group label	N total	N top 30%	N top 30% Islamo-phobic	% in top 30% Islamo-phobic
C0	News & Politics	867	260	4	1.53
C1	Propaganda	680	204	8	3.92
C2	Propaganda	221	66	3	4.54
C3	Entertainment	92	28	0	0
C4	-	-	-	-	-
C5	Religion & Spirituality	77	23	0	0
C6	Religion & Spirituality	47	14	0	0
C7	Islamic State News videos	1774	532	13	2.44
C8	Education	36	11	0	0
C9	Gaming	72	22	0	0
C10	Gaming	87	26		0
C11	Islamophobic Content	70	21	1	4.59

C12	Movie Trailers	137	41	0	0
C13	People & Blogs	286	86	0	0
C14	Entertainment	831	249	0	0
C15	Entertainment	81	24	0	0
C16	Documentaries	88	24	0	0
C17	Music	240	72	0	0
C18	Entertainment	133	40	0	0
C19	Religion & Spirituality	51	15	0	0
C20	People & Blogs	98	29	0	0
C21	Entertainment	85	29	0	0
C22	Music	120	36	0	0
C23	Religion & Spirituality	130	39	0	0
C24	Religion & Spirituality	214	65	0	0
C25	-	-	-	-	-
C26	Education	9	3	0	0
C27	Gaming	88	26	0	0
C28	Islamophobic Content	1487	446	26	5.82
C29	Islamophobic Content	1731	519	36	6.93
C30	Documentaries	131	45	0	0
C31	Education	24	7	0	0
C32	Religion & Spirituality	381	114	0	0

FIGURE S1

YouTube networks obtained with search keys targeting Islamophobic and Islamist content. Labels for groups are provided in Tables S3 and S2.

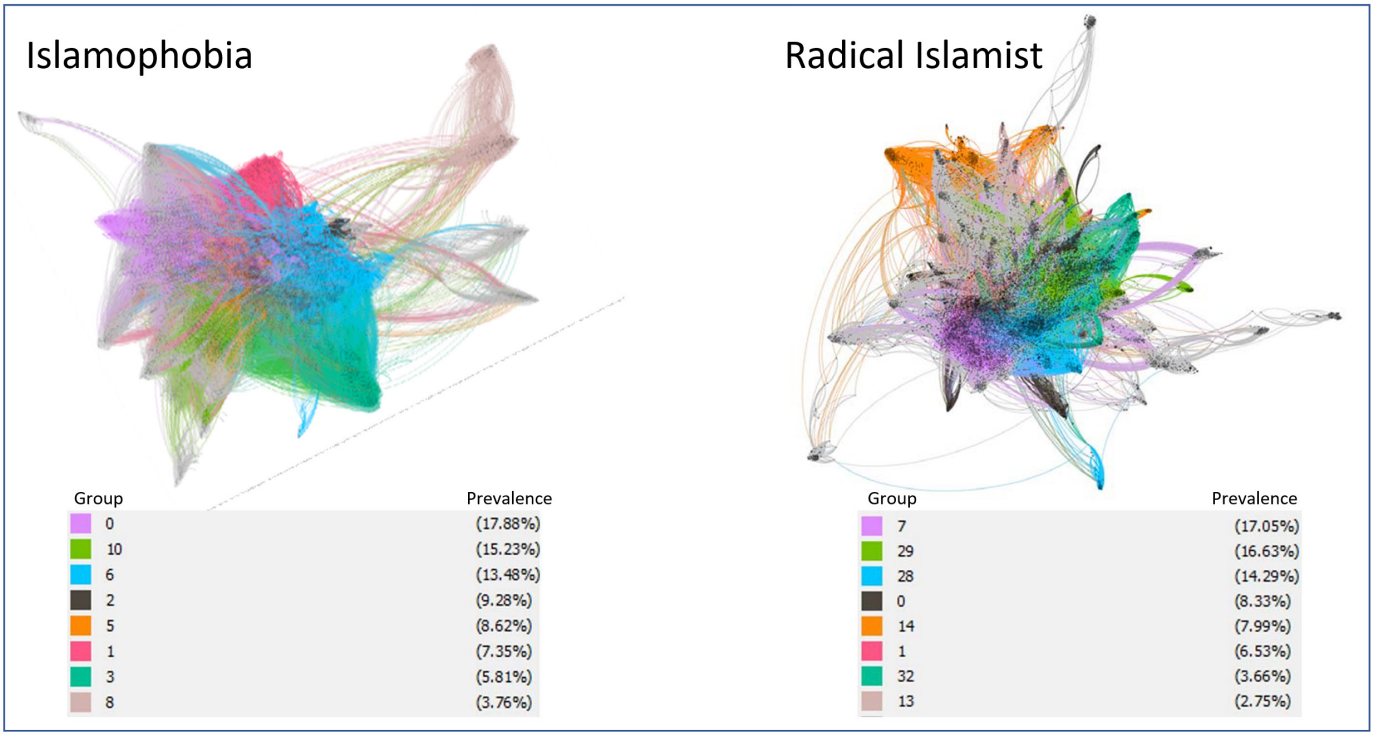
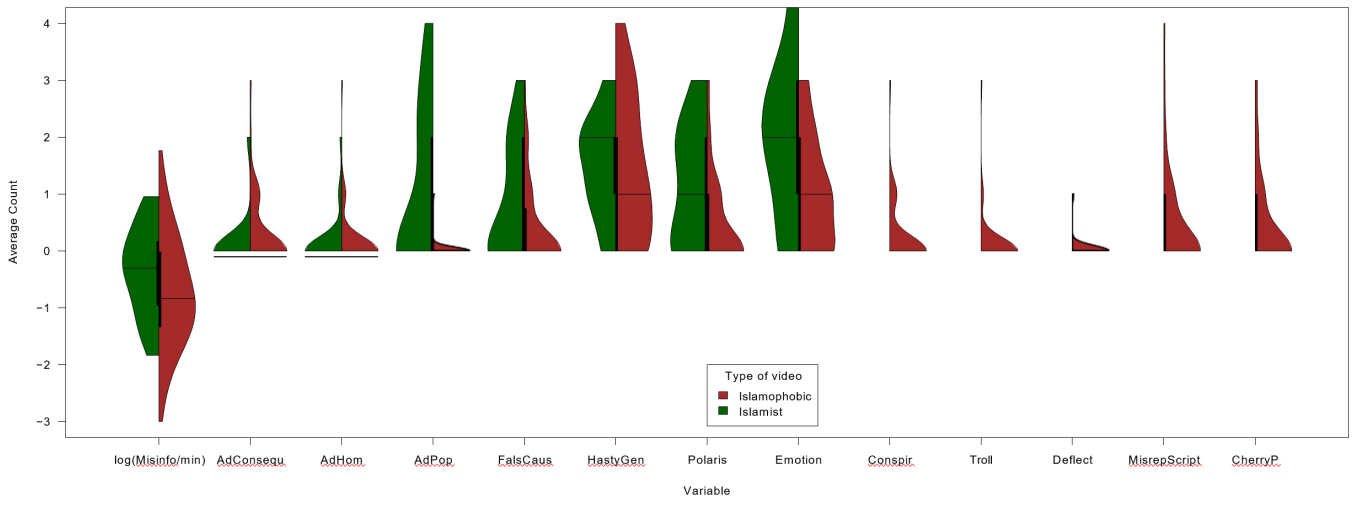


FIGURE S2

Average count of misinformation techniques identified in the Radical-Islamist (green) and Islamophobic (brown) networks.



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