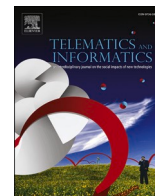




ELSEVIER

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Telematics and Informatics

journal homepage: www.elsevier.com/locate/tele

Who inadvertently shares deepfakes? Analyzing the role of political interest, cognitive ability, and social network size

Saifuddin Ahmed^{*}

Nanyang Technological University, Singapore

ARTICLE INFO

Keywords:

Deep fakes
Political interest
Social network size
United States
Singapore

ABSTRACT

The social and democratic implications of deepfakes (also *deep fakes*) technology are widely debated in the United States and elsewhere. Yet, we know surprisingly little about how online users engage with this newer form of disinformation. This study is one of the first to explore the inadvertent deepfakes sharing behavior of the citizenry. Drawing on survey data collected in the United States and Singapore, this study investigates the role of political interest, cognitive ability, and social network size in inadvertent deepfakes sharing. The findings suggest that those with higher political interests are more likely to share deepfakes inadvertently. Those with lower cognitive ability are also more likely to share deepfakes inadvertently. The moderation findings suggest that the relationship between political interest and deepfakes sharing is significantly moderated by network size. As such, the likelihood of politically interested citizens sharing deepfakes intensifies in more extensive social networks. These results are consistent across both contexts.

1. Introduction

Recent evidence suggests that those who are highly interested in politics are more likely to intentionally and unintentionally share disinformation on social media than their low interested counterparts (Chadwick and Vaccari, 2019). This report is pitted against a backdrop of a body of research which has appreciated the supportive role of political interest in contributing to the development of democratic processes (e.g., Brady et al., 1995; Glenn and Grimes, 1968; Kim, 2018; Shani, 2009). This body of work has suggested that higher political interest transfers into higher political engagement, mainly because it determines how news is consumed in a high-choice media environment (Lecheler and de Vreese, 2017; Strömbäck et al., 2013), how citizens consume political information and engage in motivated information processing (Prior, 2007), and how citizens transfer higher news consumption into higher levels of political learning and participation (Ahmed and Cho, 2019; Delli Carpini and Keeter, 1996; Eveland and Scheufele, 2000; Verba et al., 1995; Yamamoto et al., 2018). Therefore, why do politically interested users share disinformation on social media? This may occur because although politically interested social media users are more active news consumers, they may be at no real advantage compared to low-interest users in evaluating the credibility of disinformation (Stefanone et al., 2019). Therefore, because they are significantly more likely to consume and share online news, there are at greater risk of propagating disinformation as compared to politically disinterested or less avid news consumers.

^{*} Address: Wee Kim Wee School of Communication and Information, Nanyang Technological University, 31 Nanyang Link, Singapore 637718, Singapore

E-mail address: sahmed@ntu.edu.sg.

<https://doi.org/10.1016/j.tele.2020.101508>

Received 17 May 2020; Received in revised form 18 September 2020; Accepted 21 September 2020

Available online 1 October 2020

0736-5853/© 2020 Elsevier Ltd. All rights reserved.

While disinformation is gaining scholarly attention (De keersmaecker and Roets, 2017; Grinberg et al., 2019; Shen et al., 2019; Talwar et al., 2019; Valenzuela, Halpern et al., 2019; Wasserman and Madrid-Morales, 2019), few studies have explored the role of political interest in disinformation sharing (cf Chadwick and Vaccari, 2019). Furthermore, a critical research gap is an understanding of the sharing behavior around deepfakes. Deepfakes are a new form of disinformation. They are artificial intelligence (AI)-driven manipulated media made to look convincing enough, in which people's words and actions are fabricated. Recent incidents of the use of deepfakes in political campaigns suggest that they may be used to mislead citizens and ruin the integrity of democratic processes (Parkin, 2019; Turk, 2019). Consequently, there is an urgent need to explore and understand deepfakes sharing behavior.

This study is one of the first to explore the role of political interest in deepfakes sharing behavior. Using two sets of primary data collected from online survey panels in the United States and Singapore, this study tests the empirical association between political interest, cognitive ability, online social network characteristics, and inadvertent deepfakes sharing. Additionally, the study also examines the moderation effect of user's cognitive ability and social network size on the relationship between political interest and inadvertent deepfakes sharing. With enhanced generalizability across two contexts, the findings provide nuanced insights on the effects of motivational (political interest), cognitive (cognitive ability), and network characteristic (social network size) factors on deepfakes sharing behavior.

2. Literature review

2.1. Deepfakes: A new form of disinformation

Deepfakes are an emerging form of disinformation involving doctored multimedia content. Their growing impact on the social and political landscape is a cause for widespread concern since they threaten to destabilize governments and sway public opinion. In a provincial election in India in 2020, deepfakes were used for the first time (Christopher, 2020). The team behind the deepfake argued that their manipulated video constituted a "positive campaign" (Christopher, 2020). Still, scholars believe that there is a cause of alarm since deepfakes now have demonstrated applicability in sabotaging elections and influencing civic trust (Chesney and Citron, 2019).

As of mid-2020, several deepfakes have gone viral in the United States. Among the ones related to politics, notable videos include one that shows President Obama using swear words against President Trump, and Mark Zuckerberg admitting that Facebook manipulates its users (Eadicicco, 2019). More recently, the Democratic National Committee (DNC) used a deepfake of its chair, Tom Perez, apologizing for not being in attendance at a large convention (O'Sullivan, 2019). The video ended with a debriefing identifying the video as fake. The DNC used this video as a demonstration of the potential threats of deepfakes in the 2020 Presidential election (O'Sullivan, 2019).

Concerns regarding the potential of such manipulative content in deceiving citizens have drawn wide technological and regulatory attention. The Defense Advanced Research Projects Agency in the United States funded a project to develop tools to spot the counterfeit deepfakes automatically (Knight, 2018). More recently, Twitter and Facebook also implemented policies to ban AI-manipulated deepfakes in a bid to restrict the spread of disinformation (Hern, 2020; Murhpy, 2020). Partnership on AI, a multistakeholder organization working on AI's social impacts, also collaborated with Facebook and several educational institutions to create a Deepfake Detection Challenge to produce technology available for the detection of deepfakes (Culliford, 2019). Beyond the use of technology, there has also been a push to use laws to address the challenges posed by disinformation. A select committee appointed by the Singaporean parliament to study the problem of deliberate online falsehoods concluded that deepfakes could be created relatively easily and cheaply and as such, the 'ease, speed, reach and impact of online falsehoods are unprecedented' (Report of the Select Committee on Deliberate Online Falsehoods, 2019, p.14). In 2019, the Singapore government introduced the Protection from Online Falsehoods and Manipulation Act to address the challenges of disinformation spread, including deepfakes. However, some experts believe that while such regulations are helpful, they are 'chasing a moving target', and more significant efforts are required for media literacy to cultivate citizens who can discern deepfakes (Tham and Seah, 2019).

Deepfakes are a lethal form of disinformation because they manipulate reality. Deepfakes are a visual form of disinformation that fulfills the "realism heuristic" (Frenda et al., 2013), where online users are more likely to trust visual information rather than a text-based description of the world (see Vaccari and Chadwick, 2020). As the technology used in deepfakes creation evolves, it will be more challenging to discern fact from fiction.

Deepfakes can also cast shadows over factual information and can be used as a "liar's dividend" where people can use the trend of deepfakes to delegitimize reliable information (Chesney and Citron, 2019, p 1758). For example, US President Donald Trump questioned the legitimacy of the "Access Hollywood" video and termed it as doctored. Similarly, in a lesser discussed event, Gabon's president, Ali Bongo's video appearance, was believed to a deepfake culminating in an unsuccessful coup by the military (Christopher, 2020).

While grave political turmoils due to deepfakes are still rare, there is growing consensus among experts that deepfakes are a potential threat to democracies (Chesney and Citron, 2019). Diakopoulos and Johnson (2019) use an anticipatory ethics approach within the context of the 2020 US presidential election to caution against the potential of deepfakes to 'harm viewers, subjects, and electoral integrity including deception, intimidation, reputational harm, misattribution, and undermining of trust in electoral processes' (p.18). The authors suggest that deepfakes can harm audiences by deception and impede their ability to make legitimate informed decisions. Similarly, Vaccari and Chadwick (2020), in an empirical analysis, found that those who were exposed to deepfakes were found to be more uncertain and less trustful of news on social media. As such, we need a more considerable scholarly effort to understand civic behavior surrounding deepfakes, that can help us understand and limit the foreseeable disinformation threats.

2.2. Political interest and deepfakes sharing

In the new media environment, the proliferation of the choices available to audiences allows them to practice motivated media consumption behavior. In other words, those who are interested in politics can choose to selectively consume political news (Prior, 2007; Zaller, 1992), while those who are moderately or not interested in politics can eschew news and instead consume entertainment media. Recent studies have found that politically interested individuals are frequently exposed to news content on social media (Thorson et al., 2019). This may occur due to selective exposure that suggests individual preferences realized through selective media choices will determine the content users are exposed to (Messing and Westwood, 2014; Nelson and Webster, 2017). This may also occur because politically interested users are more likely to have friends who are also politically interested; as such, this homophily will increase the likelihood of exposure to news (McPherson et al., 2001). Politically interested social media users are also more likely to be presented with algorithmically driven political news and information (Thorson et al., 2019) and incidentally exposed to news on social media (Karnowski et al., 2017; Heiss and Matthes, 2019). In sum, the politically interested, driven by their consumption and network characteristics on social media, are more frequently exposed to news than those who are moderately or not at all interested in political affairs.

While the democratic benefits of exposure to news content online are well-acknowledged (Gil de Zúñiga et al., 2015; Hopp et al., 2018; Kim and Chen, 2016), a rising concern is that the politically interested are also at a higher risk of engagement with disinformation. Recent evidence suggests that the citizens with higher levels of political interest are more likely to knowingly and unknowingly share disinformation on social media sites as compared to those with lower levels of interest (Chadwick and Vaccari, 2019). This pattern can be explained through the general news consumption and sharing behavior of the politically interested. The politically interested citizens are voracious news consumers and thus, exhibit a higher likelihood of sharing of news in general (Karnowski et al., 2018). Consequently, when these individuals are exposed to disinformation, they are also found to be active sharers of disinformation. Although the politically interested citizens are expected to employ better information processing abilities, they are found to be no different than their low interested counterparts in evaluating the credibility of disinformation (Stefanone et al., 2019).

We anticipate the disinformation sharing behavior observed amongst the politically interested to also occur with deepfakes. The politically interested often rely on social media platforms such as Facebook, Twitter, YouTube, and Instagram as primary sources of news. However, these platforms are now becoming the centerstage of deepfakes. The increased exposure to deepfakes would also increase the likelihood of sharing, especially when the manipulated media are harder to distinguish from reality as compared to other forms of disinformation. A recent survey found that a majority of Americans frequently encounter altered videos or images, and most of them believe that it is challenging to identify the manipulative nature of such media (Gottfried, 2019). Thus, it is likely that the previously observed positive relationship between high political interest and disinformation sharing will also be observed in this study. Therefore, it is hypothesized that:

H1. Political interest is positively associated with inadvertent deepfakes sharing.

2.3. Cognitive ability and deepfakes sharing

The dual-process theory separates human cognition into the intuitive and subconscious processes (system 1) and the more time-intensive analytical and deliberative (system 2) processes. It is argued that this framework reveals a crucial facet of our cognition: the ability or the motivation to think analytically (see Pennycook and Rand, 2019). Scholars have claimed that since most humans are cognitive misers, they do not prefer to utilize the cognitive skills in information evaluation tasks (Fiske and Taylor, 2013; Stanovich and West, 2000). Therefore, not all aspects of a message are considered, and instead, the misers tend to focus on only some salient features to encode the messages (Lang, 2000). Nonetheless, some individuals are more cognitively able and exhibit more reasoned behavior than the rest.

Individuals with higher cognitive ability are known to make sound judgments when they engage with disinformation. Empirical validation has highlighted that individuals with higher cognitive skills are well-adjusted in discerning facts from disinformation (Pennycook and Rand, 2019) and readjusting attitude while engaging with disinformation (De keersmaecker and Roets, 2017). Previous findings also support the thesis that cognitive ability is positively related to efficient information processing (Lodge and Hamill, 1986) and better decision making (Gonzalez et al., 2005). Thus, based on these arguments, it is expected that more analytical thinking will support both, a better discerning of manipulated deepfakes from reality, and an effective decision-making process resulting in an avoidance of sharing deepfakes. However, the “realism heuristic” (Frenda et al., 2013) utilized by deepfakes and its propagation on social media poses a new challenge.

User interaction with the media is in a state of automaticity, where they do not engage in critical thinking (Potter, 2004). Empirical evidence confirms that online users consume news with an uncritical eye and are usually unsuccessful in making sound judgments in news selection (Powers, 2014). Thus, it is plausible that those who consume news from online sources, and especially from social media platforms, would be at a higher risk of being exposed to and spreading deepfakes. Moreover, the cognitive processing of deepfakes might not be of much help. Neural cognition literature suggests that human faces and face-like stimuli are processed relatively earlier in the brain and are not a delayed readjusted cognitive phenomenon (Hadjikhani et al., 2009). As such, even if deepfakes are not flawless and merely mirror a real face, it might be cognitively difficult to supersede the early impressions made at the neural level (Smith, 2019). Thus, based on these arguments, there is a likelihood that higher cognitively abled individuals will not be better in discerning facts from fiction. Given the lack of existing evidence supporting either thesis, a research question is proposed instead of a hypothesis:

RQ1: How is cognitive ability related to inadvertent deepfakes sharing?

Other than the direct effects of cognitive ability on inadvertent sharing of deepfakes, it is also probable that cognitive ability can moderate the relationship between political interest and inadvertent deepfakes sharing behavior. As discussed earlier, the more politically interested individuals would be more likely to be exposed to news in general (Thorson et al., 2019) and incidental exposure to news (Heiss and Matthes, 2019). Higher news exposure may increase the likelihood of exposure to deepfakes. As such, the importance of information processing ability is heightened under such conditions. If cognitive ability were to buffer against the manipulative nature of deepfakes, it is plausible that politically interested citizens with higher cognitive ability would refrain from sharing such deepfakes. However, due to a lack of research and a directional expectation, a research question is proposed instead of a hypothesis:

RQ2: How does cognitive ability moderate the relationship between political interest and inadvertent deepfakes sharing?

2.4. Social network size and deepfakes sharing

Social network size, often conceptualized as a critical network resource, is found to promote communication within the network (Shen et al., 2009). Social media users with more friends have a higher likelihood of information opportunities (Chan, 2016). Furthermore, they are more engaged (Gil de Zúñiga et al., 2015; Kwak, Williams et al., 2005), and they are more likely to share content within their networks (Kim and Lee, 2011; Madge et al., 2009). Having a more extensive network gives individuals a greater sense of social cohesion as users share content to build and maintain relationships within their networks (Burke and Kraut, 2016; Burke et al., 2011; Nowland et al., 2018). Furthermore, recent disinformation research has confirmed that the sharing of disinformation is more frequent in more extensive social networks than smaller networks (Burbach et al., 2019). To contain such spread of disinformation, WhatsApp, one of the most frequently used social media applications, has restricted the network size membership limits (Flamini, 2019). In brief, individuals with a more extensive network are more likely to not only encounter disinformation but also share them. When applied within the context of this present study, it is expected that individuals with a large number of friends on social media, driven by greater exposure, will share deepfakes more frequently. This expectation is especially valid when they are not aware of the manipulated nature of the content (e.g., deepfakes) and might end up sharing them for social gains. However, due to a lack of previous evidence concerning deepfakes, a research question is proposed:

RQ3: How is social network size related to inadvertent deepfakes sharing?

Beyond such effects, social network size can also have a moderating influence on the relationship between political interest and deepfakes sharing. We are aware that citizens with high political interest use social media for greater informational purposes, and more extensive social networks would amplify opportunities to encounter political information. Increased engagement with political content is found to be associated with frequent disinformation sharing (Valenzuela et al., 2019). Thus, it is likely that politically interested citizens with more extensive networks may share deepfakes more frequently than those with smaller networks simply because they encounter deepfakes more regularly than low politically interested citizens.

However, it is also likely that extensive networks facilitate those with low political interest to share deepfakes. More extensive social networks increase the likelihood of social endorsements and repetition of information. When users have limited prior knowledge of a subject, they often rely on social cues within social media for information credibility (Gao et al., 2015). As such, citizens with low levels of political interest may depend on the social cues of others to judge political content. Given the manipulative nature of deepfakes, it is probable that not all social signals attached deepfakes within the networks of low politically interested citizens would be well-informed. Therefore, more extensive social networks may increase the likelihood of misguided social cues propagation. As such, it may also amplify the likelihood of deepfakes being shared, primarily when low interested citizens rely on others for political information credibility. Due to a lack of previous research on this topic, a research question is proposed instead of a hypothesis.

RQ4: How does social network size moderate the relationship between political interest and inadvertent deepfakes sharing?

3. Method

3.1. Sample

The data were collected by a reputable market research firm, Qualtrics. The firm adopted a quota-based approach, where a sample was drawn from a group of respondents, who closely matched the population parameters focusing on age and gender distribution in both countries. Similar stratified online quota samples are frequently used to generalize the findings to the national population (Gil de Zúñiga et al., 2015; Groshek and Koc-Michalska, 2017). The surveys were fielded in February-March 2020, and the total sample comprised 1244 respondents in the United States and 1231 respondents in Singapore.

Survey participants were provided with a definition of deepfakes and queried whether they were aware of deepfakes prior to the survey. In alignment with the goals of this study (a focus on behavior associated with deepfakes), the analyses focused on those respondents who were aware of deepfakes before the survey. Since the awareness of deepfakes is still not broad, an inclusion of responses from those who were not aware of deepfakes could risk false positives. Consequently, a total of 764 respondents (61.4% awareness) in the United States and 662 respondents (53.8% awareness) in Singapore constituted the final sample for this study. Those who were aware of deepfakes in both countries were, in general, more politically interested than those who were not aware. No statistical differences concerning the levels of cognitive ability and network size were found between those who were and not aware of deepfakes (see Appendix A).

3.2. Measures

Inadvertent deepfakes sharing was measured by asking the respondents if they had ever shared a deepfake accidentally that they later found out was a hoax (0 = never, 1 = once, 2 = more than once). The item was recoded into a binary measure (0 = not shared, 1 = shared). A total of 39.1% of respondents in the United States and 33.2% of respondents in Singapore (who are aware of deepfakes) agreed to share deepfakes inadvertently.

Political interest was measured by asking the respondents to rate their level of interest (1 = not at all to 5 = extremely) in politics and public affairs (United States: $M = 3.77$, $SD = 1.10$; Singapore: $M = 2.92$, $SD = 1.05$).

Cognitive ability was measured using a 10-item Wordsum test (Thorndike, 1942) (United States: $M = 5.14$, $SD = 2.85$, range = 10, $\alpha = 0.80$; Singapore: $M = 5.73$, $SD = 2.38$, range = 10, $\alpha = 0.74$). The responses to 10-items were summed to create an index of cognitive ability.

The vocabulary test shares high variance with general intelligence and has been frequently used to assess the cognitive capability of individuals (Brandt and Crawford, 2016; Caplan and Miller, 2010; Ganzach et al., 2019). Weschler (1958, p.84) supports the use of a vocabulary test to measure cognitive ability and argues, “contrary to lay opinion, the size of a man’s vocabulary is not only an index of his schooling but also an excellent measure of his general cognitive ability. Its excellence as a test of cognitive ability may stem from the fact that the number of words a man knows is at once a measure of his learning ability, his fund of verbal information, and the general range of his ideas.”

The test can be utilized in Singapore since English is the primary language of the education system in Singapore, and it is also the most spoken language in the country (Singapore General Household Survey, 2015).

Social network size was measured by asking respondents to estimate the approximate number of friends they have on the social network that they use the most (1 = 0–50 people, 2 = 51–200 people, 3 = 201–500 people, 4 = 501–1000 people, 5 = 1001–2000 people, and 6 = more than 2000 people) (United States: $M = 2.79$, $SD = 1.63$; Singapore: $M = 2.54$, $SD = 1.39$).

Demographic variables, including age, gender, education, income, and race, were used as controls. This study also accounts for the levels of political trust, deepfakes exposure, and concerns regarding deepfakes as controls. The demographic report is summarized in Table 1.

Political trust was measured by asking respondents to rate their level of trust in the national government on a seven-point scale. A higher value represents greater political trust (United States: $M = 4.40$, $SD = 1.96$; Singapore: $M = 4.51$, $SD = 1.29$). Political trust was included since an engagement with disinformation has been found to affect trust in political institutions (Ognyanova et al., 2020).

Deepfakes exposure was created as an index of averaging two items asking respondents how frequently (1 = not at all to 5 = extremely) do they come across deepfakes on social media sites and the internet in general, other than social media sites (United States: $M = 2.79$, $SD = 1.43$, Spearman-Brown (SB) Coefficient = 0.92; Singapore: $M = 2.63$, $SD = 1.05$, SB Coefficient = 0.90).

Deepfakes concern was measured by two items, asking respondents how concerned (1 = not at all to 5 = extremely) are they with the use and online trend of deepfakes. Two items were combined to form an index (United States: $M = 3.62$, $SD = 1.20$, SB Coefficient = 0.91; Singapore: $M = 3.18$, $SD = 1.11$, SB Coefficient = 0.88).

The statistical models for the United States also included *partisanship* (1 = strong democrat to 7 = strong republican) and *mainstream media trust* ($M = 3.40$; $SD = 1.11$, min–max = 1 to 5) as control variables.¹

4. Results

Before investigating the proposed hypotheses and research questions, this study examined the statistical differences in inadvertent deepfakes sharing, exposure to and concern regarding deepfakes, political interest, cognitive ability, and social network size of respondents in the United States and Singapore.

The percentage of respondents who inadvertently shared deepfakes significantly differed between countries, $\chi^2(2, 1426) = 5.34$, $p < .05$. The respondents in the United States were more frequent in inadvertently sharing deepfakes than those in Singapore.

The *t*-test analyses (see Table 2) suggested that the respondents in the United States had higher levels of exposure to deepfakes, $t(1390.74) = 2.26$, $p < .05$, greater concerns regarding deepfakes, $t(1417.33) = 7.24$, $p < .001$, and higher levels of political interest, $t(1409.36) = 14.74$, $p < .001$ than the respondents in Singapore. The respondents in the United States also had more extensive social networks, $t(1423.76) = 3.09$, $p < .001$. On the other hand, respondents in Singapore had higher levels of cognitive ability as compared to those in the United States, $t(1421.82) = -4.30$, $p < .001$.

Logistic regressions were performed to examine the predictors of inadvertent deepfakes sharing in both countries. This was followed by logistic regressions with two-way interaction effects using the cognitive ability and social network size as moderators to estimate their moderating effects on the relationship between political interest and inadvertent deepfakes sharing. The range of VIF values for all models were below the acceptable limits (United States: 1.11 to 2.04; Singapore: 1.02 to 1.51)². The results are summarized in Table 3.

Among the control variables, deepfakes exposure was found to be positively associated with inadvertent deepfakes sharing in both

¹ Mainstream media trust was created by asking the respondents how frequently do they trust mainstream news organizations a) nationally, b) locally, and c) internationally (e.g., how much do you trust the information you get from national news organizations) on a five-point scale (1 = not at all to 5 = extremely).

² Linear regression procedures were used to calculate the VIF values.

Table 1
Descriptive of controls.

Variable	Description	United States		Singapore	
Gender		57.3% males		55.4% males	
Race		81.7% majority		79.6% majority	
Age		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Education	(United States: 1 = no formal to 8 = doctoral degree; Singapore: 1 = no formal to 9 = post graduate degree)	44.31	16.40	39.67	12.47
Income	(1 = less than \$1000 to 11 = more than \$20,000)	5.95	1.23	7.33	1.45
		6.51	3.45	5.90	2.73

The correlations are included in Appendix B and C.

Table 2
Summaries of between-country comparison.

	United States		Singapore		<i>t</i>	χ^2 <i>df</i>
	% (<i>N</i>)		% (<i>N</i>)			
Deepfakes sharing	39.1 (299)		33.2 (220)			5.34*
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Deepfakes exposure	2.79	1.43	2.64	1.05	2.26	1390.74*
Deepfakes concern	3.62	1.20	3.18	1.11	7.24	1417.33***
Political interest	3.77	1.10	2.92	1.05	14.74	1409.36***
Cognitive ability	5.14	2.85	5.73	2.38	-4.30	1421.82***
Network size	2.79	1.63	2.54	1.39	3.09	1423.76**

Note. *df* = degrees of freedom; US *N* = 764; Singapore *N* = 662; **p* < 0.05; ***p* < 0.01; ****p* < 0.001.

Table 3
Summary of logistic regressions predicting inadvertent deepfakes sharing.

	United States			Singapore		
	B	(SE)	Exp (B)	B	(SE)	Exp (B)
<i>Block 1</i>						
Controls						
Age	-0.018	(0.008)*	0.983*	0.004	(0.009)	1.004
Gender (females)	0.233	(0.226)	1.263	-0.360	(0.201)	0.697
Education	0.080	(0.102)	1.084	0.047	(0.077)	1.048
Income	-0.005	(0.034)	0.995	0.018	(0.040)	1.018
Race (majority)	0.221	(0.271)	1.247	-0.516	(0.264)*	0.597*
Political trust	0.060	(0.067)	1.062	-0.017	(0.080)	0.983
Deepfakes exposure	0.711	(0.100)***	2.037***	0.852	(0.111)***	2.343***
Deepfakes concern	-0.025	(0.102)	1.026	-0.112	(0.098)	0.894
Partisanship	0.106	(0.054)*	1.112*	-	-	-
Mainstream media trust	-0.100	(0.130)	0.905	-	-	-
Independent variables						
Political interest	0.216	(0.110)*	1.241*	0.320	(0.106)**	1.377**
Cognitive ability	-0.338	(0.048)***	0.713***	-0.348	(0.045)***	0.706***
Network size	0.067	(0.074)	1.069	0.060	(0.083)	1.062
Nagelkerke R ²	0.598			0.358		
<i>Block 2: Moderation</i>						
Political interest × cognitive ability	0.016	(0.040)	1.016	0.052	(0.041)	1.053
Political interest × network size	0.118	(0.060)*	1.126*	0.141	(0.070)*	1.151*
Nagelkerke R ²	0.602			0.366		

Note. United States *N* = 762; Singapore *N* = 661; **p* < 0.05; ***p* < 0.01; ****p* < 0.001.

the United States, *B* (*SE*) = 0.711 (0.100), *Exp* (B) = 2.037, *p* < .001, and Singapore, *B* (*SE*) = 0.852 (0.111), *Exp* (B) = 2.343, *p* < .001. Therefore, individuals who frequently exposed to deepfakes were more likely to inadvertently sharing them. This result is consistent with recent studies that have found a positive association between exposure to disinformation and disinformation sharing behavior (Grinberg et al., 2019; Halpern et al., 2019). In the United States, republicans were more likely to inadvertently share deepfakes than democrats *B* (*SE*) = 0.106 (0.054), *Exp* (B) = 1.112, *p* < .05.

Regarding the main effects of the independent variables of interest (block 1), political interest was found to be positively related to inadvertent deepfakes sharing in both countries [United States, *B* (*SE*) = 0.216 (0.110), *Exp* (B) = 1.241, *p* < .05; Singapore, *B* (*SE*) = 0.320 (0.106), *Exp* (B) = 1.377, *p* < .01]. Therefore, in line with current research on disinformation (Chadwick and Vaccari, 2019), this study confirms the idea that those with higher levels of political interest are more likely to share deepfakes inadvertently. Thus, H1 was supported.

In addition, cognitive ability was found to be negatively associated with inadvertent deepfakes sharing in both the United States, $B (SE) = -0.338 (0.048)$, $\text{Exp} (B) = 0.713$, $p < .001$ and Singapore, $B (SE) = -0.348 (0.045)$, $\text{Exp} (B) = 0.706$, $p < .001$, thereby confirming that individuals with higher cognitive ability are less likely to inadvertently share deepfakes (RQ1).

Regarding RQ3, it was found that social network size is not significantly associated with inadvertent deepfakes sharing in either of the countries.

Recall RQ2 and RQ4 explored the moderation effects of cognitive ability and social network size on the relationship between political interest and inadvertent deepfakes sharing. The results (block 2) suggests that the relationship between political interest and inadvertent deepfakes sharing is moderated by social network size with statistical significance in both, United States, $B (SE) = 0.118 (0.060)$, $\text{Exp} (B) = 1.126$, $p < .05$, and Singapore, $B (SE) = 0.141 (0.070)$, $\text{Exp} (B) = 1.151$, $p < .001$; (RQ4). The relationship is plotted in Fig. 1. The moderation relationship of cognitive ability on political interest and inadvertent deepfakes sharing is not significant in either the United States or Singapore (RQ2).

5. Discussion

This study is one of the first to offer insights into the inadvertent sharing of deepfakes and highlights the role played by political interest, a key motivation for political engagement, is also positively associated with the sharing of deepfakes.

The core findings of the study emphasize the unintentional adverse effects of political interest and the mitigating influence of cognitive ability. Politically interested users are frequent consumers of news and information. They are more likely to be following journalists and news organizations on social media, a relationship that is positively associated with sharing information online (Weeks and Holbert, 2013). Sharing news and information is also considered a socially engaging activity that produces significant individual and interpersonal consequences (Choi and Lee, 2015), including substantial political learning and participatory benefits. Therefore, politically interested citizens might be inadvertently sharing deepfakes because of several reasons, including increased exposure to news and information, network characteristics, and to accrue social and political gains.

While political interest increases the likelihood of inadvertent deepfakes sharing, this study also finds that cognitive ability is negatively associated with deepfakes sharing in both the United States and Singapore. Thus, individuals with high cognitive skills are less likely to share deepfakes. Notably, the effects of cognitive ability on deepfakes sharing are observed even after controlling for education. A common assumption is that cognitive skills mirror education (Herrnstein and Murray, 1994). However, education and cognitive skills are not collinear. Measures of education often inadequately capture cognitive skills (Hauser, 2000; Raudenbush and Kasim, 1998). The findings of the study highlight that the ability to distinguish the false nature of deepfakes from real information lies in the differences in the cognitive skills of online users. Perhaps, along with digital media literacy, a greater emphasis on the development of the cognitive abilities of online users is required to restrict the spread of deepfakes.

This study did not detect the direct impact of social network size on deepfakes sharing. However, it was observed that the propensity to share deepfakes inadvertently was significantly higher for politically interested citizens with more extensive social networks than those with smaller networks. The pattern of this observation was stable across both countries. Citizens with high political interest are more involved and informed about public and political affairs than others. Politically interested citizens are found to be self-designated opinion leaders (Shah and Scheufele, 2006; Wadbring and Ödmark, 2016), especially when they have more extensive social networks. Park and Kaye (2017, p.178) argue that the self-perceived level of ‘opinion leadership in the social media age is not a function of the presence of certain predispositions or personal characteristics so much as a function of the size and diversity of an individual’s network.’ Further, opinion leadership is often associated with perceived intelligence and social sharing of judgment about public affairs (Chan and Misra, 1990). Drawing inferences from these studies, we speculate that when they receive new information (in

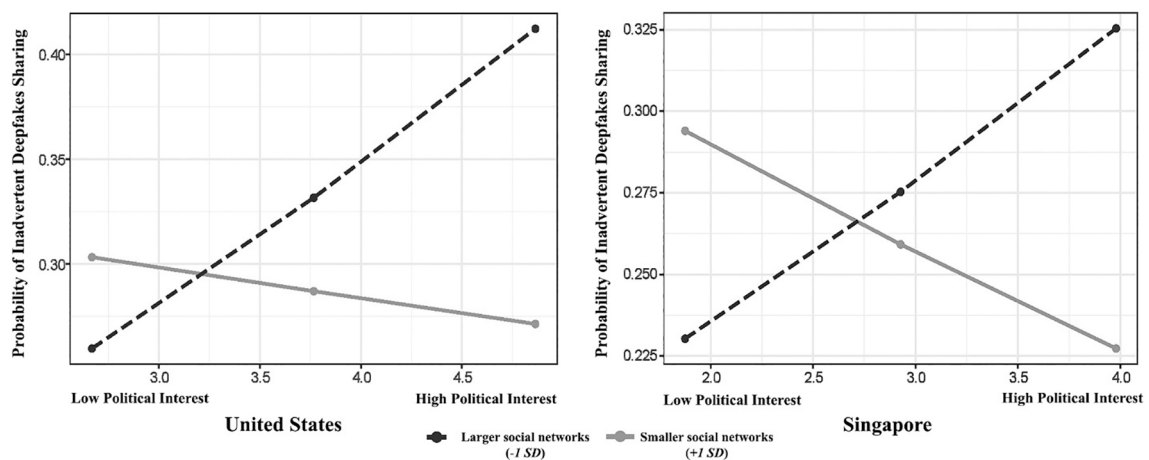


Fig. 1. Visualization of the interaction effect of political interest and social network size on inadvertent deepfakes sharing. All covariates are set to mean value.

the form of a deepfake), they are motivated to share such content (without the realization of its manipulative nature) within their networks with the aim of more extensive social influence.

This study reveals that when politically interested users engage with manipulative media, it may lead to adverse consequences in the form of disinformation spread, which are more pronounced in politically interested users with more extensive social networks. It may be unfeasible to anticipate and eradicate deepfakes from social media platforms (Chesney and Citron, 2019). As a first step, tech companies like Facebook, Twitter, and Google label manipulated online content such as deepfakes (Schoolov, 2019; Shead, 2020). But consequently, we need more efforts in the form of digital media literacy and cognitive development programs to educate individuals with lower cognitive skills, who are more vulnerable when exposed to disinformation. While we are still in the early days of deepfakes and most of the content is restricted to pornographic websites (Simonite, 2019), it is difficult to deny that manipulated deepfakes will have a much-amplified impact in the days to come. Therefore, stricter regulations implemented by tech companies in combination with a broader skillset development of low cognitive individuals are required to counteract the damaging effects of deepfakes.

Our findings also reveal some interesting differences in how deepfakes are perceived in the United States versus Singapore. Though not the central aim of this study, a formal statistical comparison reveals that respondents in the United States were more concerned and exposed to deepfakes and thereby also accidentally shared more deepfakes than those in Singapore. These findings are not surprising, given the widespread relevance and public discussion surrounding deepfakes in the United States. More recently, a rise in the number of deepfakes, including fabricated deepfakes of Richard Nixon and President Donald Trump, has raised anxieties regarding the damaging potential of this form of disinformation. Singapore, on the other hand, has not witnessed direct impacts of deepfakes, and the government has preventively introduced the Protection from Online Falsehoods and Manipulation Bill to limit the threat posed by disinformation, including deepfakes (Fang, 2019). However, this does not eliminate the threat posed by deepfakes for the Singaporean society. A recent survey found that 80% of Singaporeans believed that they could discern real from fake news, yet 90% of the respondents failed to identify a fake news headline (Fang, 2019). The government's legislation to inhibit the pervasive threat of disinformation would help, but more efforts will be required to educate the citizenry in effectively negating deepfakes.

Finally, we recognize some of the limitations of this study. First, the study uses self-reported survey data in analyzing deepfakes behavior. The operationalization of inadvertent deepfakes behavior is dependent on respondents' recollection of such sharing. It is likely others could have inadvertently shared deepfake without any realization or recollection. The relationships reported in this study can be explored through experimental frameworks to make precise causal inferences. Second, while excluding those respondents who were not aware of deepfakes before the study increases the specificity of the findings, it also creates a bias. The sample used here was more politically interested than those who were not aware of deepfakes. As such, the generalizability of the findings is limited. Third, this study measures *general* political interest as a single item, which is useful to compare the overall political interest of social media users across contexts. However, in future work, a more nuanced understanding of political interest could offer further insights, such as general political interest or electoral interest in deepfake sharing. Finally, this study chose to operationalized cognitive ability via verbal intelligence, a dimension closely associated with other forms of intelligence (Colom et al., 2005). Future scholars may explore if the patterns generalize, as they are expected to, across other dimensions of cognitive ability (e.g., numerical and visuospatial skills). Notwithstanding the limitations, the robustness of the findings across two contexts offers essential insights into inadvertent deepfakes sharing behavior of the citizenry.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

This study was funded by the 2019 Nanyang Technological University Start-up Grant [grant number M4082415.060] and the Singapore Ministry of Education Academic Research Fund Tier 1 Grant [grant number 2019-T1-002-053].

References

- Ahmed, S., Cho, J., 2019. The roles of different news media use and press freedom in education generated participation inequality: an eight country comparative analysis. *J. Broadcast. Electron. Media* 63 (3), 566–586.
- Brady, H.E., Verba, S., Schlozman, K.L., 1995. Beyond SES: A resource model of political participation. *Am. Political Sci. Rev.* 89 (2), 271–294.
- Brandt, M.J., Crawford, J.T., 2016. Answering unresolved questions about the relationship between cognitive ability and prejudice. *Soc. Psychol. Personality Sci.* 7 (8), 884–892.
- Burbach, L., Halbach, P., Ziefle, M., Calero Valdez, A., 2019. In: June). Who Shares Fake News in Online Social Networks?. *Adaptation and Personalization*, pp. 234–242.
- Burke, M., Kraut, R.E., 2016. The relationship between facebook use and well-being depends on communication type and tie strength. *J. Comput. Med. Commun.* 21 (4), 265–281.
- Burke, M., Kraut, R., & Marlow, C. (2011). Social capital on facebook: Differentiating uses and users. 571–580. <https://doi.org/10.1145/1978942.1979023>.
- Caplan, B., Miller, S.C., 2010. Intelligence makes people think like economists: Evidence from the General Social Survey. *Intelligence* 38 (6), 636–647.
- Carpini, M.X.D., Keeter, S., 1996. What Americans know about politics and why it matters. Yale University Press.
- Chadwick, A., Vaccari, C., 2019. News Sharing on UK Social Media: Misinformation, Disinformation, and Correction. *Survey Report*. Available online [ormation_disinformation_and_correction/9471269](https://www.digitalcommons.ilse.org/communicationandcorrection/9471269) Accessed on 25 September 2019.
- Chan, K.K., Misra, S., 1990. Characteristics of the opinion leader: A new dimension. *J. Adv.* 19 (3), 53–60.
- Chan, M., 2016. Social network sites and political engagement: Exploring the impact of Facebook connections and uses on political protest and participation. *Mass Commun. Soc.* 19 (4), 430–451.

- Chesney, B., Citron, D., 2019. Deep fakes: A looming challenge for privacy, democracy, and national security. *California Law Review* 107, 1753–1820.
- Choi, J., Lee, J.K., 2015. Investigating the effects of news sharing and political interest on social media network heterogeneity. *Comput. Hum. Behav.* 44, 258–266.
- Christopher, N. (2020). We've Just Seen the First Use of Deepfakes in an Indian Election Campaign. *VICE Reports*. Available at https://www.vice.com/en_in/article/jgedjb/the-first-use-of-deepfakes-in-indian-election-by-bjp.
- Colom, R., Abad, F.J., Rebollo, I., Shih, P.C., 2005. Memory span and general intelligence: A latent-variable approach. *Intelligence* 33 (6), 623–642.
- Culliford, E. (2019, 6 September) Facebook, Microsoft launch contest to detect deepfake videos. *Reuters*. Available at <https://www.reuters.com/article/us-facebook-microsoft-deepfakes/facebook-microsoft-launch-contest-to-detect-deepfake-videos-idUSKCN1VQ2T5>.
- De keersmaecker, J., Roets, A., 2017. 'Fake news': Incorrect, but hard to correct. The role of cognitive ability on the impact of false information on social impressions. *Intelligence* 65, 107–110.
- Diakopoulos, N., & Johnson, D. (2019). Anticipating and addressing the ethical implications of deepfakes in the context of elections. *New Media & Society, Online First*.
- Eadicicco, L. (2019, 12 June). There's a fake video showing Mark Zuckerberg saying he's in control of 'billions of people's stolen data,' as Facebook grapples with doctored videos that spread misinformation. *Business Insider*. Available at <https://www.businessinsider.com/deepfake-video-mark-zuckerberg-instagram-2019-6>.
- Eveland Jr, W.P., Scheufele, D.A., 2000. Connecting news media use with gaps in knowledge and participation. *Political Commun.* 17 (3), 215–237.
- Fang, N. (2019). Getting Singaporeans involved in the fight against fake news. *Today*. Available at <https://www.todayonline.com/commentary/getting-singaporeans-involved-fight-against-fake-news>.
- Fiske, S., Taylor, S., 2013. *Social cognition: From Brains to Culture*, 2nd ed. McGraw-Hill, New York NY.
- Flamini, D. (2019). WhatsApp efforts to curb misinformation aren't entirely effective, research shows. *Pointer*. Available at <https://www.poynter.org/fact-checking/2019/whatsapp-efforts-to-curb-misinformation-arent-entirely-effective-research-shows/>.
- Frenda, S.J., Knowles, E.D., Saletan, W., Loftus, E.F., 2013. False memories of fabricated political events. *J. Exp. Soc. Psychol.* 49 (2), 280–286.
- Ganzach, Y., Hanoch, Y., Choma, B.L., 2019. Attitudes toward presidential candidates in the 2012 and 2016 American elections: Cognitive ability and support for Trump. *Soc. Psychol. Personality Sci.* 10 (7), 924–934.
- Gao, Q., Tian, Y., Tu, M., 2015. Exploring factors influencing Chinese user's perceived credibility of health and safety information on Weibo. *Comput. Hum. Behav.* 45, 21–31.
- Gil de Zúñiga, H., Garcia-Perdomo, V., McGregor, S.C., 2015. What is second screening? Exploring motivations of second screen use and its effect on online political participation. *J. Commun.* 65 (5), 793–815.
- Glenn, N.D., Grimes, M., 1968. Aging, voting, and political interest. *Am. Sociol. Rev.* 33 (4), 563–575.
- Gonzalez, C., Thomas, R.P., Vanyukov, P., 2005. The relationships between cognitive ability and dynamic decision making. *Intelligence* 33 (2), 169–186.
- Gottfried, J. (2019). About three-quarters of Americans favor steps to restrict altered videos and images. *Pew Research Center Survey*. Available at <https://www.pewresearch.org/fact-tank/2019/06/14/about-three-quarters-of-americans-favor-steps-to-restrict-altered-videos-and-images/>.
- Grinberg, N., Joseph, K., Friedland, L., Swire-Thompson, B., Lazer, D., 2019. Fake news on Twitter during the 2016 US presidential election. *Science* 363 (6425), 374–378.
- Groshek, J., Koc-Michalska, K., 2017. Helping populism win? Social media use, filter bubbles, and support for populist presidential candidates in the 2016 US election campaign. *Inf. Commun. Soc.* 20 (9), 1389–1407.
- Hadjikhani, N., Kveraga, K., Naik, P., Ahlfors, S.P., 2009. Early (N170) activation of face-specific cortex by face-like objects. *NeuroReport* 20 (4), 403.
- Halpern, D., Valenzuela, S., Katz, J., Miranda, J.P., 2019. In: July). From Belief in Conspiracy Theories to Trust in Others: Which Factors Influence Exposure, Believing and Sharing Fake News. Springer, Cham, pp. 217–232.
- Hauser, S.M., 2000. Education, ability, and civic engagement in the contemporary United States. *Soc. Sci. Res.* 29 (4), 556–582.
- Heiss, R., Matthes, J., 2019. Does incidental exposure on social media equalize or reinforce participatory gaps? Evidence from a panel study. *New Med. Soc.* 21 (11–12), 2463–2482.
- Hern A (2020, 7 January) Facebook bans 'deepfake' videos in run-up to US election. *The Guardian*. Available at <https://www.theguardian.com/technology/2020/jan/07/facebook-bans-deepfake-videos-in-run-up-to-us-election>.
- Herrnstein, R., Murray, C., 1994. *The Bell Curve*. The Free Press, New York.
- Hopp, T., Santana, A., Barker, V., 2018. Who finds value in news comment communities? An analysis of the influence of individual user, perceived news site quality, and site type factors. *Telematics Inform.* 35 (5), 1237–1248.
- Karnowski, V., Kumpel, A.S., Leonhard, L., Leiner, D.J., 2017. From incidental news exposure to news engagement. How perceptions of the news post and news usage patterns influence engagement with news articles encountered on Facebook. *Comput. Hum. Behav.* 76, 42–50.
- Karnowski, V., Leonhard, L., Kumpel, A.S., 2018. Why users share the news: A theory of reasoned action-based study on the antecedents of news-sharing behavior. *Commun. Res. Rep.* 35 (2), 91–100.
- Kim, J., Lee, J.-E.-R., 2011. The Facebook paths to happiness: Effects of the number of Facebook friends and self-presentation on subjective well-being. *Cyberpsychology, Behavior and Social Networking* 14 (6), 359–364.
- Kim, M., 2018. How does Facebook news use lead to actions in South Korea? The role of Facebook discussion network heterogeneity, political interest, and conflict avoidance in predicting political participation. *Telematics Inform.* 35 (5), 1373–1381.
- Kim, Y., Chen, H.T., 2016. Social media and online political participation: The mediating role of exposure to cross-cutting and like-minded perspectives. *Telematics Inform.* 33 (2), 320–330.
- Knight W. (2018, 23 May). The US military is funding an effort to catch deepfakes and other AI trickery. *MIT Technology Review*. Available at <https://www.technologyreview.com/2018/05/23/142770/the-us-military-is-funding-an-effort-to-catch-deepfakes-and-other-ai-trickery/>.
- Kwak, N., Williams, A.E., Wang, X., Lee, H., 2005. Talking politics and engaging politics: An examination of the interactive relationships between structural features of political talk and discussion engagement. *Commun. Res.* 32 (1), 87–111.
- Lang, A., 2000. The limited capacity model of mediated message processing. *J. Commun.* 50 (1), 46–70.
- Lecheler, S., de Vreese, C.H., 2017. News media, knowledge, and political interest: Evidence of a dual role from a field experiment. *J. Commun.* 67 (4), 545–564.
- Lodge, M., Hamill, R., 1986. A partisan schema for political information processing. *Am. Polit. Sci. Rev.* 80 (2), 505–519.
- Madge, C., Meek, J., Wellens, J., Hooley, T., 2009. Facebook, social integration and informal learning at university: It is more for socialising and talking to friends about work than for actually doing work. *Learning, Med. Technol.* 34 (2), 141–155.
- McPherson, M., Smith-Lovin, L., Cook, J.M., 2001. Birds of a feather: Homophily in social networks. *Ann. Rev. Sociol.* 27 (1), 415–444.
- Messing, S., Westwood, S.J., 2014. Selective exposure in the age of social media: Endorsements trump partisan source affiliation when selecting news online. *Commun. Res.* 41 (8), 1042–1063.
- Murphy, M. (2020, 4 February). Twitter bans 'deepfakes' and 'cheap fakes'. *The Telegraph*. Available at <https://www.telegraph.co.uk/technology/2020/02/04/twitter-bans-deepfakes-cheap-fakes/>.
- Nelson, J.L., Webster, J.G. (2017). The myth of partisan selective exposure: A portrait of the online political news audience. *Social Media+ Society*, 3(3), 2056305117729314.
- Nowland, R., Necka, E.A., Cacioppo, J.T., 2018. Loneliness and Social Internet Use: Pathways to Reconnection in a Digital World? *Perspectives on Psychological Science* 13 (1), 70–87. <https://doi.org/10.1177/1745691617713052>.
- Ognyanova, K., Lazer, D., Robertson, R.E., Wilson, C., 2020. Misinformation in action: Fake news exposure is linked to lower trust in media, higher trust in government when your side is in power. *Harvard Kennedy School Misinformation Review*.
- O'Sullivan, D., 2019, August. The Democratic Party deepfaked its own chairman to highlight 2020 concerns. *CNN*. Available at <https://edition.cnn.com/2019/08/09/tech/deepfake-tom-perez-dnc-defcon/index.html>.

- Park, C.S., Kaye, B.K., 2017. The tweet goes on: Interconnection of Twitter opinion leadership, network size, and civic engagement. *Comput. Hum. Behav.* 69, 174–180.
- Parkin, S. (2019). Politicians fear this like fire. *The Guardian*. Available at <https://www.theguardian.com/technology/ng-interactive/2019/jun/22/the-rise-of-the-deepfake-and-the-threat-to-democracy>.
- Pennycook, G., Rand, D.G., 2019. Lazy, not biased: Susceptibility to partisan fake news is better explained by lack of reasoning than by motivated reasoning. *Cognition* 188, 39–50.
- Potter, W., 2004. Argument for the need for a cognitive theory of media literacy. *American Behavioral Scientist* 48 (2), 266–272.
- Powers, E. (2014). How students access, filter and evaluate digital news: Choices that shape what they consume and the implications for news literacy education (Doctoral dissertation).
- Prior, M., 2007. Post-broadcast democracy: How media choice increases inequality in political involvement and polarizes elections. Cambridge University Press, New York.
- Raudenbush, S., Kasim, R., 1998. Cognitive skill and economic inequality: Findings from the National Adult Literacy Survey. *Harvard Educational Review* 68 (1), 33–80.
- Report of the Select Committee on Deliberate Online Falsehoods (2019). Report of the Select Committee on Deliberate Online Falsehoods – Causes, Consequences, and Countermeasures. Available at <https://sprs.parl.gov.sg/selectcommittee/selectcommittee/download?id=1&type=subReport>.
- Schoolov, K. (2019). How Facebook, Twitter and Google are working to prevent deepfakes from fooling you. CNBC. Available at <https://www.cnbc.com/2019/09/29/how-facebook-twitter-and-google-work-to-detect-and-prevent-deepfakes.html>.
- Shah, D.V., Scheufele, D.A., 2006. Explicating opinion leadership: Nonpolitical dispositions, information consumption, and civic participation. *Political Communication* 23 (1), 1–22.
- Shani, D., 2009. On the origins of political interest (Doctoral dissertation). Princeton University, Princeton, New Jersey.
- Shed, S. (2020). Facebook to ban 'deepfakes'. BBC. Available at <https://www.bbc.com/news/technology-51018758>.
- Shen, C., Kasra, M., Pan, W., Bassett, G.A., Malloch, Y., O'Brien, J.F., 2019. Fake images: The effects of source, intermediary, and digital media literacy on contextual assessment of image credibility online. *New Media & Society* 21 (2), 438–463.
- Shen, F., Wang, N., Guo, Z., Guo, L., 2009. Social network size, efficacy, and opinion expression: Assessing the impacts of Internet use in China. *International Journal of Public Opinion Research* 21 (4), 451–476.
- Simonite, T. (2019). Most Deepfakes are Porn, and They're Multiplying Fast. WIRED. Available at <https://www.wired.com/story/most-deepfakes-porn-multiplying-fast/>.
- Singapore General Household Survey (2015). Singapore General Household Survey. Department of Statistics, Ministry of Trade & Industry, Republic of Singapore. Available at <https://www.singstat.gov.sg/-/media/files/publications/ghs/ghs2015/ghs2015.pdf>.
- Smith, T., 2019. The Neuroscience of Deepfakes. *Medium*. Available at <https://medium.com/@tsmith1992/the-neuroscience-of-deepfakes-1018758>.
- Stanovich, K.E., West, R.F., 2000. Individual differences in reasoning: Implications for the rationality debate? *Behavioral and brain sciences* 23 (5), 645–665.
- Stefanone, M.A., Vollmer, M., Covert, J.M., 2019. July. In *News We Trust? Examining Credibility and Sharing Behaviors of Fake News*. In: *Proceedings of the 10th International Conference on Social Media and Society*, pp. 136–147.
- Strömbäck, J., Djerf-Pierre, M., Shehata, A., 2013. The dynamics of political interest and news media consumption: A longitudinal perspective. *International Journal of Public Opinion Research* 25 (4), 414–435.
- Talwar, S., Dhir, A., Kaur, P., Zafar, N., Alrasheedy, M., 2019. Why do people share fake news? Associations between the dark side of social media use and fake news sharing behavior. *Journal of Retailing and Consumer Services* 51, 72–82.
- Tham, B & Seah, J (2019, 20 June). Can Fake News Law Counter AI Challenge? *The Straits Times*. Available at https://www.smu.edu.sg/sites/default/files/smu/newsroom/smu_in_the_news/2019/Jun2019/Jun20/20190620-STPT-Opinion-A25-30x23.pdf#_prclt=F2xykDX2.
- Thorson, K., Cotter, K., Medeiros, M., Pak, C., 2019. Algorithmic inference, political interest, and exposure to news and politics on Facebook. *Information, Communication & Society*, Advance online publication.
- Turk, V., 2019. Deepfakes are already breaking democracy. Just ask any woman, WIRED. Available at <https://www.wired.co.uk/article/deepfakes-pornography>.
- Vaccari, C., & Chadwick, A. (2020). Deepfakes and disinformation: Exploring the impact of synthetic political video on deception, uncertainty, and trust in news. *Social Media+ Society*, 6(1), 2056305120903408.
- Valenzuela, S., Halpern, D., Katz, J.E., Miranda, J.P., 2019. The Paradox of Participation Versus Misinformation: Social Media, Political Engagement, and the Spread of Misinformation. *Digital Journalism* 7 (6), 802–823.
- Verba, S., Schlozman, K.L., Brady, H.E., 1995. Voice and equality: Civic voluntarism in American politics. Harvard University Press, Harvard.
- Wadbring, I., Ödmark, S., 2016. Going Viral. News Sharing and Shared News in Social Media. *Observatorio (OBS*)* 10 (4), 132–149.
- Wasserman, H., Madrid-Morales, D., 2019. An Exploratory Study of "Fake News" and Media Trust in Kenya, Nigeria and South Africa. *African Journalism Studies* 40 (1), 107–123.
- Wechsler D (1958) The measurement and appraisal of adult intelligence (4th ed) Williams and Wilkins. <https://doi.org/10.1037/11167-000>.
- Weeks, B.E., Holbert, R.L., 2013. Predicting dissemination of news content in social media: A focus on reception, friending, and partisanship. *Journalism & Mass Communication Quarterly* 90 (2), 212–232.
- Yamamoto, M., Kushin, M.J., Dalisay, F., 2018. How informed are messaging app users about politics? A linkage of messaging app use and political knowledge and participation. *Telematics Inform.* 35 (8), 2376–2386.
- Zaller, J., 1992. The nature and origins of mass opinion. Cambridge University Press, Cambridge, Massachusetts.