Digital Technologies, Peace and Security:
Challenges and Opportunities for United Nations Peace Operations

Jane Esberg[1] and Christoph Mikulaschek[2]

Third draft
August 25, 2021

The digital technological landscape has changed enormously over the past decade, creating new opportunities for global communication, commerce, and effective government and public service delivery. But the same technologies have also been exploited, to exacerbate political or intercommunal tensions or enforce new restrictions on speech. These dynamics are particularly pronounced in armed conflict or post-conflict environments. This briefing provides an overview of both challenges and opportunities for contemporary UN peace operations resulting from digital technologies. Part I touches on a number of areas – including social media, cell phones, unmanned aerial vehicles, and artificial intelligence – that currently complicate prospects for peace in conflict environments, or that are likely to do so in the near future. Part II examines opportunities for UN peace operations to leverage digital technologies – including social media, cell phones, satellite imaging, unmanned aerial vehicles, closed-circuit television, and artificial intelligence – to deliver on their mandates to promote and maintain peace.

Part I: Challenges for Peace Operations

Social Media

Social media's role in polarization and conflict has attracted enormous scrutiny, particularly after high-profile acts of violence. Here we briefly touch on four topics where social media particularly influences conflict dynamics: incitement to violence; the spread of misinformation, disinformation, and propaganda; recruitment into armed groups; and the growing role of social media to suppress opposition.

Though incitement online captured particular attention with the de-platforming of former President Donald Trump in the U.S., hate speech and calls for violence have long been associated with deadly results in divided societies. Platforms are frequently used to stoke ethnic or religious tensions, and tech companies are limited in their ability to remove content quickly. Facebook's

[1] Postdoctoral Fellow, Princeton University's Empirical Studies of Conflict Project. Email: jesberg@princeton.edu.

[2] Assistant Professor, Harvard University, Department of Government. Email: mikulaschek@gov.harvard.edu.

hate speech algorithm only works in certain languages, for example, and content moderation often requires local knowledge (Perrigo, 2019; Crisis Group, 2020). Myanmar's military used Facebook to incite violence against the Royhinga Muslim minority, including by sharing fake news about the rape of a Buddhist woman by a Muslim man (Stevenson, 2018). In response, Facebook increased the number of staff focused on Myanmar (Roose and Mozur 2018, Warofka, 2018). In Cameroon, a contested election caused a rise in hate speech on Facebook and growing intercommunal violence (ICG, 2020). Even in areas without deep-seeded religious or ethnic conflict, online content can turn deadly: rumors of child organ-harvesting led to the lynching of two pollsters in Mexico, for example (Arce, 2015).

The spread of misinformation and disinformation on social media is also a global phenomenon, but can have particularly harmful effects in conflict environments. While both mis- and disinformation refer to false or misleading content, disinformation requires an intent to harm (Wardle and Derakhshan, 2017). Both can sow confusion and intensify underlying tensions. In Gabon, rumors that the president was dead or had been swapped for a body double helped fuel an attempted coup (Cahlan, 2020). Warnings circulated on social media in 2020 that the World Bank had predicted Lebanon's economic "collapse," breeding panic (World Bank, 2020). During South Sudan's peace process, rumors over the ill health of the president led to warnings about heightened risk of violence (Green, 2020). The COVID-19 pandemic has further increased the negative impact, as it leads to stigmatization of the sick and the spread of fake cures (MSF, 2020; Times of India, 2020).

Disinformation, disseminated with the intent of causing harm, has been used to fuel tensions by both domestic and international conflict actors. The Myanmar military's "True News" unit allegedly spread images showing a Muslim murdering Buddhists, which actually depicted the bodies of Bengalis after a massacre (McPherson, 2018). Disinformation can also complicate peace processes: for example, opponents of Colombia's 2016 peace deal were involved in disseminating rumors that it was meant to "collectivize the countryside" (International Crisis Group, 2017; Alsema, 2016). International actors may also be the target of disinformation. Russian media reportedly propagates narratives aimed at undermining support for rebel forces in Syria among citizens in Western countries (Alami, 2018). Aid workers can be subject to online disinformation, hindering their ability to serve local populations. Accounts allegedly linked to Russian and Syrian officials have spread false information that the White Helmets, an aid organization operating in rebel-held areas, were affiliated with al-Qaeda (Chulov, 2020). One Yemeni human rights advocate said that the Saudi coalition and Houthis "try to spread the idea that we are spies of the US… and isolate us from our community" (Sultan, 2019). Often disinformation and propaganda campaigns are supported by false accounts, trolls, and bots, to manipulate opinion and crowd out criticism (DFRLab, 2020; Atlantic Council, 2017; Barrie and Siegel, 2021).

Armed groups additionally use social media to recruit new members, by spreading propaganda or grievances, glamorizing the life of fighters, or directly targeting vulnerable populations. Though this may involve disinformation, often armed groups use social media to

publicize reports of battlefield victories or human rights violations by their enemies. In Syria they have used platforms to recruit fighters and solicit donations (Cohen, 2016, M. Berger, 2014). During Libya's civil war, rebels used social media to post about government atrocities and communicate priorities (Jones and Mattiacci, 2017). The Salafi-jihadist group the Islamic State (ISIS) has been particularly studied because of its use of social media to spread violent imagery, glorify its mission, and attract recruits (Bodine-Baron et al., 2016; Siegel and Tucker, 2018). For example, ISIS used social media to provide tips on how foreign fighters could make it into Syria while avoiding law enforcement, and to publicize battlefield victories (Zeitzoff, 2017; Khawaja and Khan, 2016; Koerner, 2016). Social media companies have, since 2016, become significantly more aggressive and adept at identifying and removing ISIS accounts and violent imagery: between 2015 and 2018, Twitter removed 1.2 million accounts associated with ISIS (Reisinger, 2018). ISIS accounts do remain on Facebook and TikTok, but they are less capable of maintaining consistent public presence (Corera, 2020; Europol, 2020; Wells, 2019).

Notably, as sites like Facebook and Twitter more aggressively remove hate speech, disinformation, and armed group pages, Encrypted Messaging Apps (EMAs) have become an increasingly common way to spread this content person-to-person (Woolley, 2020a). Because information is encrypted, it is a greater challenge to stop the spread of harmful material. ISIS has increasingly turned to EMAs, including Telegram (Katz, 2019). During anti-Muslim riots in Sri Lanka, lists of mosques to target spread through the Facebook-owned WhatsApp (Taub and Fisher, 2018). Facebook has implemented forwarding limits to slow misinformation on the messaging platform, but actually removing content would require breaking encryption (Porter, 2020). The app Signal has similar limits, but Telegram does not – as many as 200,000 people can "meet" inside a chat room (Chen and Roose, 2021).

Social media has also been increasingly used by governments to surveil and arrest opposition members. Platforms' power in driving anti-government protests has long been recognized. Facebook's expansion into new languages is associated with a rise in collective action (Fergusson and Molina, 2020), and the Arab Spring is sometimes called a "Twitter Revolution." Governments have sought to limit the platforms' potential for protest, through censorship – in China, for example, posts supportive of collective action tend to be removed far more than posts critical of the regime – and through social media blocks, discussed in the next section of this briefing (King, Pan and Roberts, 2013). But social media may also make it easier for governments to monitor and disrupt opposition (Morozov, 2012; Dragu and Lupu, 2020). Laws claiming to target "hate speech" and "fake news" have allegedly been used as a pretext to censor, fine, or imprison those who speak out against repressive or authoritarian governments, in countries from Cameroon to Nicaragua to Saudi Arabia (Pan and Siegel, 2020). In the Philippines and Cambodia, for example, governments reportedly used COVID-19 and a "fake news" law to justify arbitrary arrests (HRW, 2020c; Conde, 2020).

Internet Control

Control over the internet – who can access what online – has become an increasingly important element of conflict. Most often control of the internet rests with governments, which can shut down the internet entirely, throttle bandwidth speeds, or restrict access to specific sites (most commonly social media pages or messaging sites like Facebook, Twitter, and WhatsApp) (Linzer, 2019). Often they seek to limit the potential for collective action (Gohdes, 2015). For example, during the 2021 coup Myanmar's military imposed full internet shutdowns and specific restrictions on social media pages and sites offering VPNs (BBC, 2021). During Uganda's 2021 elections the government shut down the internet, before reducing the scope to include only social media sites (France24, 2021). In Mali, partial outages affected social media and messaging sites during protests in 2020; during the 2018 elections; and following 2016 police-protestor clashes (Netblocks, 2018; Netblocks, 2020; Kuo, 2016). In 2012, an internet blackout affected all of Syria, allegedly at the behest of the government (Gross, 2012). There were 213 instances of internet blackouts or social media blocks in 2019 (Shoker and Shoker, 2020).

Governments in some cases target specific regions for such blackouts, to isolate areas of opposition or rebel activity. In Myanmar, the government has imposed "the world's longest internet shutdown" in the Rakhine and Chin states, where the military is in conflict with rebel groups (HRW, 2020b). During an offensive against Kurdish forces in northern Syria, Turkey allegedly restricted access to social media sites (Martineau, 2019). In the contested region of Kashmir, the Indian government reportedly barred broadband and mobile internet services, stating that doing so was important to maintaining security (Masih et al., 2019).

Internet restrictions are usually carried out through direct requests to Internet Service Providers (ISPs). While ISPs can be state-run, even independent companies typically comply with such requests because of economic example motivations, fears about employee safety, and local law or contract clauses. In the DR Congo in 2017, for example, the telecommunications regulator reportedly sent the following to ISPs requesting throttling: "In order to prevent the exchange of abusive images via social media by your subscribers, I ask you to… take technical measures to restrict to a minimum the capacity to transmit images" (Linzer, 2019).

While governments most often interfere with the internet, subnational conflict actors at points develop their own telecommunications structures, or take over ISPs themselves. In Aleppo, anti-government forces established an illegal internet satellite network, both to continue communication within Syria and to share images of human rights violations internationally (Peterson, 2012). When Houthi rebels took control of Yemen's capital Sana'a in 2014, they took over the internet infrastructure as well. They now control the .ye domain space and the main ISP (YemenNet), compelling the government of President Hadi to create their own (Insikt Group, 2018). Houthis have used this for censorship and surveillance, in part using easily available software from international firms (Poetranto, 2015; Insikt Group, 2019).

Internet shutdowns have a clear impact on the ability of aid and peacekeeping agencies to operate. In some cases, these shutdowns appear specifically designed to shroud human rights

abuses (Miles, 2019). Reporting from conflict zones and identifying areas in need of aid or civilian protection becomes significantly more difficult with limited internet. For UN peacekeeping, "effective communications to facilitate messaging up and down the chain with important operational administrative, and real-time safety information is not a luxury, but rather a lifesaving necessity" (Dette, 2018).

Cell Phones

The most fundamental impact of cell phones on conflict comes from increased communication. Research has shown that the expansion of cell coverage increases violent conflict and protest in Africa, primarily by aiding in collective action – though this may be an artifact of increased reporting (Manacorda and Tesei, 2020; Pierskalla and Hollenbach, 2013; Weidmann, 2016). Other work has found that cell phones reduce specifically government-orchestrated violence, because it means any attacks have an audience (Christensen and Garfias, 2018). In civil war, cell phones may both make it easier for rebels to coordinate amongst one another, and for the government to communicate with civilians (Siegel and Shapiro, 2015; Shapiro and Weidmann, 2015). In Syria, for example, cell phones were used by rebels to coordinate; Assad also used mass texts for propaganda, including a nationwide announcement it was "game over" for insurgents (Engel, 2012; CBS News, 2012; Peterson, 2012).

Cell phones can also be used more directly for both violence and intimidation. They frequently act as remote detonators for bombs. For example, ISIS fighters use simple phones to set off improvised explosive devices (IEDs) (Conflict Armament Research, 2016). In Iraq, bombs could be precisely made to go off when U.S. convoys passed using cell phones (Ziegler, 2009). Widening availability of smart phones facilitates the creation and dissemination of violent propaganda. The Taliban used cell phones to send videos and text messages deterring support for the Afghan government (BBC, 2012).

Cellular devices can also be used for surveillance, though these technologies are still relatively new. Law enforcement in some countries use "stingrays" or "dirtboxes" to collect information from cell phones; they are controversial because they collect data from any phones in the vicinity of targeted devices (Zetter, 2020). Location tracking technology based on cell phones has been widely exported, and could be used to track citizens, such as participants in protests (Steinert-Threlkeld, 2015). Phone location data is often anonymized and sold, but concerns are growing this could similarly be used for surveillance (Warzel and Thompson, 2019). Cell phone geolocation data is also becoming more common as a way to target propaganda (Woolley, 2020b).

Drones

Drones, or unmanned aerial vehicles (UAVs), have become significantly more available in recent years, particularly as commercial availability skyrockets. With this, a growing set of countries and non-state actors have acquired the technology, though drones range from large

military vehicles to small UAVs priced at under $1,000 (Overton et al., 2017; Grossman, 2018b). Drones are frequently used for reconnaissance purposes, both by government and non-state actors (Lin-Greenberg and Milonopolous, 2021). Drones have reportedly been used for surveillance in the Syrian conflict by Russian, American, Turkish, and Iranian forces (Ackerman, 2012; Stewart, 2015; Pamuk and Stewart, 2020).

For both governments and subnational armed groups, they have the benefit of being airborne – allowing them to overcome ground defenses – and of being unmanned, and thus presenting no physical risk. Drones can be made quite accurate and are difficult to spot. Drone strikes by governments have become significantly more common over the last decade. The Obama administration conducted approximately 540 such attacks in Yemen, Pakistan, and Somalia, primarily as part of a targeted killing process (Rumi, 2015). Turkey has reportedly used drones in strikes on Kurdish rebel groups, Nigeria has allegedly attacked Boko Haram, and Azerbaijan has reportedly targeted Armenian forces (Horowitz et al., 2020).

However, drone strikes – or at least U.S. drone strikes – are deeply unpopular, and may actually lead to backlash against the country using them (Pew Research, 2012; Rigterink, 2021). Some argue that they breed distrust against internationals on the ground, which one Somalia-based NGO said increased the number of attacks targeting aid workers (Borgen Project, 2013). The remote nature of drones makes identifying perpetrators difficult, and aerial bombing means targets are often incorrectly identified. In 2015, two aid workers held hostage by al-Qaeda were mistakenly killed in a drone strike (Rumi, 2015). The Special Rapporteur of the United Nations Commission on Human Rights on the promotion and protection of human rights and fundamental freedoms while countering terrorism has argued that CIA drone strikes in Pakistan violate national sovereignty and called for transparency to ensure humanitarian standards (UN News, 2013).

Small drones are increasingly used by non-state actors for military purposes. The Taliban has rigged drones to drop small bombs (AFP, 2020), and Houthi rebels have deployed drones rigged with explosives against Saudi targets (Al Jazeera, 2021). "Drone swarms" – groups of simultaneously deployed drones – are rare, but were recently used to attack Saudi oil facilities (Safi, 2019). Non-state armed groups have also used camera functions on drones to film attacks as a tool of propaganda. For example, ISIS has included drone-shot images in recruitment videos, designed to look like first-person-shooter video games, in an effort to attract young men (Grossman, 2018b). In some cases, groups have acquired more advanced forms of drones: Hezbollah reportedly received missile-firing drones from Iran (Grossman, 2018a).

Artificial Intelligence

Artificial intelligence technology – technology capable of tasks that might otherwise require human intelligence – is still an emerging area of research, but is set to influence conflict. The most common application is currently surveillance software. At least 75 countries operate some form of AI surveillance, often with the goal of improving public services through

automatically generated data (Feldstein, 2019a). However, concerns have intensified that AI technology – and particularly facial recognition technology – may be used to identify and suppress government opponents. China has allegedly developed a predictive policing program in the heavily Uighur province of Xinjiang to analyze and aggregate multiple sources of data, including biometric information and closed-circuit TV feeds. As part of this initiative, the government has reportedly developed facial recognition software and is building a national image registry, which could be used to track individuals (Feldstein, 2019b). It has allegedly sold its CloudWalk facial recognition software to Zimbabwe (HRW, 2018).

Artificial intelligence is also being applied to the social media sphere. AI can be used to automatically deploy bots or trolls in response to certain discussions online, to flood out information or suppress dissent (FreedomHouse, 2017). To drown out information on protests related to Russian opposition leader Alexei Navalny's detention, Instagram posts with AI-generated faces were geotagged to the Red Square (DFRLab, 2021). Deepfakes – videos that appear real, the result of using a method called deep learning – can create more believable disinformation. Currently the majority of deepfakes target women, though a number of politically-motivated videos have circulated on social media (Vaccari and Chadwick, 2020).

The use of drones, too, will be affected by AI. Military drones remain guided by humans; autonomous drones would be able to complete tasks without any intervention. While they have not to date been deployed, autonomous drones capable of surveilling areas or delivering supplies are in development or have been developed (Dyndal et al., 2017; Judson, 2021). At some point, such autonomous drones may be used to build Lethal Autonomous Weapons Systems (LAWS) that can identify, select, and deploy against targets chosen without human intervention – allowing operations in areas where communication is difficult or impossible, but also raising considerable ethical risks (CRS, 2020). Sometimes called "killer robots", there have been calls to preemptively ban their use under international law (HRW, 2020).

Emerging Threats

This section touches on additional emerging threats that will likely grow in importance in conflict in the coming years. While these technologies do not currently play a widespread role in violence – particularly outside the major powers – they are developing and diffusing rapidly.

Cyber weapons and cyberattacks are used for purposes from financial gain through phishing or spam, to election hacking, to destroying or tampering with critical infrastructure. Cyberattacks can be hard to attribute, making them more difficult to restrain. Cyber weapons are primarily deployed by governments: for example, groups reportedly linked to Russia have breached electoral systems, spread misinformation, and stolen data (CSIS, 2021). The Syrian government has allegedly used spyware and malware to track dissidents (Gallagher, 2012). However, substate actors have increasingly gained access to cyber weapons, as the cost of computing power lowers (Jones et al., 2018). In January 2021, hackers linked to Hezbollah

attacked telecommunications companies across a number of governments to gather intelligence and steal data (Schaefer, 2018). Humanitarian and UN missions rely on the internet, meaning their ability to assist civilians could be compromised with cyberattacks (Marelli, 2020).

As the technology develops, 3D-printed weapons will likely also represent a challenge. Also known as "ghost guns," they do not have serial numbers or any other marking that might identify the owner, making them effectively untraceable (Slisco, 2020). Hypothetically such guns could be made solely from plastic, meaning they would not set off metal detectors or could be made inside locations with printers. Currently, however, making a gun still requires at least the use of a steel nail as a firing pin, and materials are not durable enough to fire multiple rounds (Smith et al., 2018; Steckelberg, 2018). Blueprints for homemade guns have been shared online, on social media and encrypted platforms like Signal (Hanrahan, 2019).

Part II: Opportunities for UN peace operations

Social media and UN peace operations

(1) Social media as a means of public information and community engagement

Fifty-seven million social media users live in countries where UN peace operations are currently deployed (Kemp, 2020). The most obvious way in which contemporary UN peace operations can leverage social media to deliver on their mandates is to use social media as a means to communicate with the public. As of 25 February, 2021, seven of the twelve ongoing missions had Twitter accounts (in addition to accounts of specific units and actors within missions). Collectively, these seven accounts had more than 620,000 followers who had seen some of the peace operations' 77,000 tweets in their news feeds. The UN's "legitimacy, its promotion of collective action, and its universality" (Birnback, 2019: 2) help explain why social media users inside and outside the area of operation seek out information from UN peacekeepers. Considerable variation in social media use for strategic communication exists across UN peace operations, with three large missions (MONUSCO, MINUSMA, and UNMISS) accounting for more than 82 percent of UN peace operations' tweets. Undoubtedly, variation in peace operations' mandates and strategic settings accounts for some of this variation. At the same time, there may be room for sharing lessons learned and best practices across missions in order to enable the peace operations that least actively use social media to realize the full potential of this technology. This section also puts forth a series of specific suggestions.

In addition to using social media as a means of public information, UN peace operations can also use social media as a channel for public engagement during critical periods of the mission's life cycle. The 2018 Libyan National Conference Process (NCP) provides an example. The Center for Humanitarian Dialogue designed a website that was optimized for users with low-bandwidth Internet access. The website and a separate Facebook page provided information about

the NCP and an online questionnaire that enabled Libyan citizens to provide feedback. The NCP had 138,000 Facebook followers, generated half a million comments, and 1,700 persons completed the questionnaire (Jenny et al., 2018: 33).

The use of social media to communicate with the public is not without perils. When UN peace operations 'follow' controversial actors or groups on Twitter or 'friend' them on Facebook, they invite criticism and may even tarnish the perception of impartiality. Missions that regularly comment on security incidents lead the public to expect instant public responses – even in those cases where the mission leadership prefers to discreetly engage with conflict parties' leaders instead of immediately issuing a public condemnation or comment. When the public is invited to complete online questionnaires without a proper risk assessment and stringent data safety measures, sensitive data about political attitudes could be hacked and used by conflict parties to identify and punish dissenters.

(2) Social media as a data source for real-time analyses

Especially in the volatile contexts in which UN peace operations often operate, the analysis of social media data can provide valuable and real-time insights into public opinion in the area of operation. For instance, a recent study mined Tweets to examine political sentiments of Indian Twitter users before the 2019 national election and to make inferences about the likely election outcome (Ansari et al., 2020). Another publication investigated Tweets in Arabic to systematically analyze anti-interventionist attitudes in the Middle East and public responses to terrorist attacks and other events (Jamal et al., 2015). A third study evaluated social media posts during Côte d'Ivoire's 2011 electoral violence (Schreiner, 2018). These are just a few examples that illustrate the potential of tracking social media posts to gain real-time or near-real-time insights into public opinion in volatile environments. UN peace operations can harness this potential by building analytic capacity in-house or by collaborating with external experts.

Tracking hate speech online is a particularly salient task for peacekeepers tasked with protecting civilians and/or supporting host countries that bear the responsibility to protect their populations from mass atrocities. Mission leadership could gain valuable insights into rising tensions through real-time tracking of online hate speech. Past academic and civil society projects have achieved this goal in some contexts. For instance, *Umati* monitored online content and recorded instances of hate speech ahead and during Kenya's 2013 national election (Gagliardone, 2014).

The analysis of social media data can also track the micro dynamics of armed conflict. A study by Zeitzoff (2011) relied on Twitter and other social media data to measure military behavior by Israel and Hamas during the 2008-9 Gaza war and to document their response to the adoption of UN Security Council resolution 1860 (2009). Specifically, the author triangulated evidence from several social media feeds that documented conflict events in real time, and whose reports

had been authenticated by mainstream Israeli or Arab news media organizations. The expansion of social media over the past decade makes similar work even more promising today.

Public health is another issue area that can be tracked in real time by observing social media data. A study detected a very strong correlation between Tweets mentioning ailments and flu statistics in the United States – but the former becomes available before the latter (Paul and Dredze, 2011). Other work relied on Google search data to estimate infectious disease activity, for example by tracking Dengue-related searches to obtain near-real-time estimates of incidence rates (Yang et al., 2017). Recently, a global repository of Covid-19-related Tweets in many languages has been constructed and published, which can be used to track social media responses to Covid-19-related events and the spread of misinformation about the pandemic (Chen *et al*., 2020). These studies support the conclusion that by tracking real-time social media data we can detect early signs of public health crises before official data become available.

While these projects primarily rely on social media data for analytic purposes, others integrate social media data into internet platforms to facilitate information-sharing, coordination, analysis, and M&E. For instance, ActivityInfo was established by UNICEF, OCHA, and BeDataDriven and serves the purpose of real-time monitoring of the humanitarian situation in the Eastern DR Congo (Karlsrud, 2014).

To make use of data collected from social media requires tools for tracking and analyzing trends, though the right tool depends on the goals of a project. Certain online platforms designed for social media "listening" provide user-friendly interfaces to access subsets of social media data, and often include visualizations. These platforms can provide simple descriptive information about trends in specific search terms, particularly useful if, for example, the goal of the project is to see the growth of a certain hashtag. Examples of such platforms include ProBox, Meltwater, and Brandwatch.

However, if the goal of the project is to monitor underlying tensions or violent rhetoric, more complex forms of analysis may be required. For example, if the goal of using social media data is to track violence, social media platforms typically provide data access to NGOs and nonprofits: Facebook offers CrowdTangle, a user-friendly platform that allows the download of posts by public groups and pages, and Twitter provides academic access to their Application Programming Interface (API), which requires some programming knowledge. The raw data can then be analyzed using methods of text analysis, which can classify tweets as relating to certain topics or adopting a certain tone. For example, text analysis has been used to track support for ISIS on Twitter in Europe by identifying tweets that express sympathy for ISIS fighters or an interest in joining them (Mitts, 2019). Others have used bots to actively discourage hate speech online (Siegel and Badaan, 2020). These more complex methods of online tracking and analysis require extensive knowledge of computational social science, which could come through partnership with outside experts.

A caveat applies to all analyses of social media data regardless of their purpose. Social media users systematically differ from the general public in terms of educational attainment, socio-economic status, gender, age, and other characteristics. If analysts extrapolate from social media users to the general public, they may arrive at erroneous conclusions. Moreover, they will fail to hear the voice of the most marginalized segments of the population whose need for protection and humanitarian assistance is often dire. Analysts must take into account the discrepancies between social media users and the public in their work.

(3) Social media as a platform for advertising job openings

UN peace operations could consider posting job ads on social media to bring job openings to the attention of a larger, more diverse pool of potential applicants. This would complement the @UN_Careers and @UNjobs Twitter accounts and others. Some social media campaigns could also target specific groups, similar to the effort by the Irish Defense Force to use Facebook to recruit women into the national armed forces (Dharmapuri, 2017).

Cell phones and UN peace operations

(1) Cell phones as a means of public information, public diplomacy, public engagement, and community alert

In 2019, the median rate of cell phone subscriptions per 100 people in countries with UN peace operations reached 69 (World Bank, 2021). 122 million cell phone subscriptions existed in these countries, and this number continues to rise at a fast pace (Ibid.). Many subscribers also access the internet with their phones. Several UN peace operations have provided toll-free phone numbers where local focal points can report imminent threats (Heningson, 2020), violence or kidnappings (Dorn, 2011: 51). Earlier, *Voix des Kivus* implemented a similar project in the Eastern DR Congo (Van der Windt and Humphreys, 2016). In Georgia, *Elva* creates a community safety network where community representatives can report violent or security incidents via text message. These projects appoint local community members as focal points and are often in regular contact with them. Focal points can raise the alert in case of imminent threat (Heningson, 2020; Karlsrud, 2014). To protect focal points against reprisals for sharing information with the mission, they remain anonymous to fellow community members. This approach has not entirely prevented such reprisals, especially in previous years when UN peacekeepers and local telecom operators provided focal points with new cell phones that made them identifiable (Heningson, 2020). Even the introduction of toll-free phone numbers did not entirely remove the risk that those who share information with the UN peace operation will face retaliation: armed groups sometimes examine the cell phone call history of civilians stopped at checkpoints in order to identify informers, and they frequently accuse those who delete their phone's call history of being an informer (see, e.g., Shaver and Shapiro, forthcoming, on the experience of non-UN-related tip lines in Iraq). In Syria,

the Standby Task Force had to abandon plans to map health facility locations partly due to concerns of potential security implications for the local informants (Puig Larrauri, 2012).

Cell phones do not only provide a means for local communities to share information about threats with UN peace operations, but cell-phone-based community alert systems can also transmit timely warnings to civilians. FrontlineSMS, a messaging system that was established in the wake of riots in Jos, Nigeria, exemplifies this approach. It broadcast alerts and automatically replied to queries about the security status by text message (Blyth, 2009).

Bulk text messages can also be sent out to help prevent violence and to counteract incitement. For instance, Kenya Safaricom donated 50 million text messages to the NGO *Sisi Ni Amani* to combat misinformation at the time of the 2013 election (Owuor and Wisor, 2014: 15; Gagliardone et al.. 2014: 25).

(2) Cell phones as a data source for real-time analyses

The establishment of toll-free lines where designated community focal points can report information to the UN peace operation is a "crowdseeding" project, because it relies on information from pre-identified contacts (who remain anonymous from their community members). In contrast, "crowdsourcing" projects invite all members of the public to provide information. Crowdsourcing projects have relied on cell phone users to provide various types of violence data, such as reports of electoral violence in Kenya in 2008 (*Ushahidi*); violence in Gaza in 2008-9 (War on Gaza: Experimental Beta); the humanitarian crisis in Libya in 2011 (LibyaCrisisMap.net); the civil war in Syria (Syria Tracker); or sexual and gender-based violence (Women under Siege). LibyaCrisisMap was initiated by OCHA to monitor news media, social media, and reports from staff in the field (The New Humanitarian, 2011). It was launched within just 48 hours and at a time when the UN lacked humanitarian access in Libya. While LibyaCrisisMap was considered a success, even a rigorous process of geolocation, approval, verification, and analysis could not prevent criticism of mixed data quality (The New Humanitarian, 2011). Even so, the need for speed and the lack of pre-identified community focal points made crowdsourcing more appealing than crowdseeding in Libya in early 2011.

LibyaCrisisMap emulated the earlier success of *Ushahidi*, which was originally established after the violent election in Kenya in 2008 to map incidents of violence (Karlsrud, 2014). It relied on data provided via text messages, email, social media, and web forms, and this information was augmented by media outlets and NGO press releases. More recent crowdsourced crisis maps also draw on data extracted from YouTube videos (Bittner et al. 2016).

Micro-level data on armed conflict are often collected through surveys that follow a rigorous sampling procedure to ensure participants are representative of the underlying population. Cell phones facilitate the administration of such surveys in several ways. First, when enumerators use smartphone survey apps (e.g., ODK Collect) while they interview the respondents in person,

they can gather location metadata in addition to the survey responses. Second, time stamps and other metadata make it easier to monitor enumerators and, thus, help ensure high data quality. Most importantly, survey apps facilitate the use of indirect question techniques that rely on randomization (Blair, Imai, and Lyall, 2014). These indirect question techniques (endorsement experiments and list experiments) give respondents the full confidence that they can honestly answer sensitive questions without having to reveal their true attitudes. Thus, they mitigate the risk of reprisals against respondents if survey data falls into the wrong hands, and they increase civilians' willingness to provide accurate responses to sensitive questions about armed groups, violence, and political attitudes. These smartphone-based techniques make it possible to obtain an unbiased picture of public attitudes in the mission area in near-real-time, which in turn can inform UN peace operations' decision-making.

While the combination of smart phones and indirect survey question techniques promises to deliver accurate results, the use of mobile networks for surveys that pose sensitive questions directly is problematic. Some surveys send out questions such as 'have you seen any incidents of physical violence / can you trust the police in your area / do you feel safe in the area you live?' to cell phone network subscribers and combine their responses with geo-spatial information (Karlsrud, 2014). This approach to data-gathering is unlikely to yield reliable data due to high non-response rates and incorrect answers to sensitive questions that are asked directly. Moreover, it may put respondents at risk of retaliation.

Even without relying on the voluntary participation of local informants, cell phone data can be leveraged to monitor unfolding crises in real time. In particular, the ubiquity of cell phones in many conflict settings makes it possible to use cell phone network data to track population movements in real time. For instance, a study used anonymized position data of SIM cards from Haiti's largest cell phone company (Digicel) to estimate population movements following the 2010 earthquake and cholera outbreak (Bengtsson et al., 2011). The UN Global Pulse Lab in Jakarta obtained anonymized call detail records from Indonesian cell phone network providers to map the geographical location of the population in order to study humanitarian and sustainable development challenges (Karlsrud, 2014).

A caveat applies to these uses of cell phone data as a data source for real-time analyses: In many armed conflict settings, some segments of the local society are excluded from access to cell phones. Thus, cell phone data does not accurately describe the whole population. When it is used uncritically to extrapolate to the entire population, the analyst will draw biased inferences that disregard the needs and concerns of those who lack access to cell phones. Moreover, when UN peace operations rely on cell phones to engage local communities, they tend to rely on elite groups to serve as intermediaries between their communities and the mission (Heningson, 2020). UN peacekeepers need to take into account that this form of community engagement tends to consolidate the power of local elites in their communities. Smartphone-based representative surveys that are conducted in person do not suffer from these shortcomings, because enumerators

interview persons with or without cell phones – and yet, smart phones provide invaluable help to surveyors and analysts.

Remote imaging

(1) Satellite imaging

For a long time, UN peacekeepers have used satellite images to accomplish their mandated tasks. The UN Situation Centre already purchased satellite data in the early 1990s (Smith, 1994: 185). Since then, technological progress and growing accessibility of high-resolution satellite imagery have greatly increased the usefulness of satellite images for UN peacekeepers. Satellite images can be used to support UN peacekeepers in fulfilling eight specific tasks: the demarcation of international boundaries, support for the negotiation and implementation of ceasefires and peace agreements, stabilization and violence prevention, electoral assistance, protection of civilians, human rights monitoring, support for the extension of state authority and the rule of law, and humanitarian assistance (Convergne and Snyder, 2015a). Following in the footsteps of Panels of Experts that have relied on satellite monitoring to determine the extent of nuclear weapons development in the DPRK and Iran (Convergne and Snyder, 2015b), UN peace operations could also leverage satellites to fulfill tasks related to sanctions monitoring. In addition, satellite imagery serves important field support purposes, e.g., when UN peacekeepers rely on satellite images to identify sources of fresh water around which they can construct compounds and when they map the accessibility of roads during the wet season (Ibid.). Last but not least, satellite images also yield intelligence that can be used to safeguard the safety and security of UN peacekeepers, premises, and assets. Detailing each of these applications of satellite imagery is beyond the scope of this paper. Therefore, the remainder of this section focuses on what is arguably the primary goal of many contemporary UN peace operations: the protection of civilians in armed conflict.

Satellite imagery can enhance the situational awareness of UN peacekeepers and enables them to take preventive action against imminent threats against civilians. For instance, UNMISS initiated the remote monitoring of a road to an at-risk city in 2013; learned about a military convoy within six hours after it was captured on a satellite image; and immediately took up strategic positions and protected civilians (Convergne and Snyder, 2015a: 572). A number of actors inside and outside the UN system have relied on satellite data to monitor human rights violations and to document mass atrocities during armed conflict: Amnesty International launched the "Eyes on Darfur" initiative and used satellite images to monitor abuses by *Boko Haram* in Nigeria (Amnesty International, 2015); the Satellite Sentinel project used the same technology to record the locations of razed villages and mass grave sites in Southern Kordofan and Abyei (Satellite Sentinel Project, 2011), and UNOSAT relied on satellites for a comprehensive report on the human toll of the Syrian civil war (UNITAR-UNOSAT, 2014).

Satellite images have also been used to identify vulnerable locations in need of protection, such as IDP shelters and refugee camps. For instance, UNOSAT used satellite data to track the fast growth of a Jordanian refugee camp during the early days of the civil war in Syria (Avtar et al., 2021) and to map active fire locations during Kenya's post-election violence in 2007-8 (Anderson and Lochery, 2008). The UNHCR asked the Standby Task Force to crowdsource the location of IDP shelters in a drought-stricken part of Somalia, and provided volunteers with instructions and satellite images to geolocate shelters (Puig Larrauri, 2012). Others have used automatic image analysis procedures to count tents in a Tanzanian refugee camp from high-resolution satellite data (Giada et al., 2003).

Nighttime light data provides an indicator of economic activity, which can be used to track human development and humanitarian crises and to evaluate economic recovery initiatives (Henderson et al., 2012). For instance, Jiang et al. (2017) relied on infrared satellite images to investigate the impact of the war in Yemen on life in Sanaa, where total nighttime light decreased by over 75% between February and June 2015. In conjunction with other measures, oil flare light data also offers remote insights into the quantity of oil production (Brandt, 2020). This approach has been used to estimate oil extraction and related revenue in ISIS-held areas and, thus, to assess the effectiveness of UN Security Council efforts to suppress terrorist financing (Do et al., 2018).

The use of satellite imagery could potentially increase the safety and security of UN peacekeepers. Satellite data can provide valuable information on threats to UN blue helmets that emanate from areas that cannot be accessed on the ground. Remote imaging is a particularly valuable complement of (but not a substitute for) ground patrols when the situation in the area of operation is volatile and gathering real-time insights at ground level is risky. When the same location (e.g., a UN base or a patrol route) is repeatedly photographed via satellite, AI used to evaluate these images could potentially detect breaks in patterns that might be early signs of an impending attack. The example of active fire maps in Kenya demonstrates that satellite-borne cameras and sensors enable the rapid detection of patterns, trends, and locations of violent events. This information can augment the situational awareness of UN peacekeepers, help them detect threats to their safety and security, and inform their decisions on how to allocate scarce resources to effectively and efficiently deliver on their mandate.

(2) Drones

Across the UN system, drones are now in use for a variety of purposes. First, they can gather images and other data remotely, which is particularly useful in areas that are inaccessible due to poor infrastructure or disasters. For instance, the IAEA employs a quadcopter to map gamma radiation at Japan's tsunami-stricken Fukushima Daiichi nuclear plant (Peeva, 2021). WFP and Mozambique deployed drones to capture aerial images for high resolution maps of areas damaged by tropical storms (WFP, 2021). FAO and Panama relied on drones for community monitoring of forests in areas affected by illegal logging (FAO, 2018). Similarly, UN peace operations mandated to support natural resource exploitation sanctions regimes could employ

drones to achieve this task. To date, UN peace operations have used drones as remotely controlled observers to monitor troop movements and to support the protection of civilians by confirming or denying the location/existence of alleged attackers (see, e.g., Kerbey, 2016). Cameras installed on drones and helicopters helped identify M23 positions in the Eastern DR Congo before the rebel group was defeated in 2013 (Dorn and Giardullo, 2020). In Ukraine and Georgia, OSCE and EU monitoring missions also rely on drones (Hansen, 2020).

Cost-effective infrared/thermal capabilities for small or medium-sized drones are now available in the market, and governments and businesses use them for purposes as diverse as search and rescue operations, surveillance, firefighting, and for the inspection of roofs, buildings, roads, bridges, refineries, and pipelines (Adorama, 2020). These capabilities can also help UN peace operations monitor troop movements and support the protection of civilians by monitoring threats.

Second, drones can boost field support and the delivery of humanitarian aid. Specifically, they can detect potential obstacles to the delivery of humanitarian aid such as roadblocks and local military interventions against unarmed humanitarian personnel. Moreover, drones can deliver low-weight supplies. UN peace operations could attain efficiency gains and a lighter ecological footprint by using drones for this purpose. In the near future, drones could also play a logistics support role in Covid-19 vaccination campaigns in areas with poor transportation networks, building on lessons learned from UNICEF's project to deliver vaccines in Vanuatu (UNICEF, 2018).

Third, drones could be used to extend WiFi connectivity or cell phone signals to refugee camps, polling stations or areas affected by natural disasters in the area of operation of UN peace operations.

(3) Closed-circuit television (CCTV)

CCTV cameras can be used to monitor potential flashpoints and vulnerable locations such as the entrances of markets and roads to IDP camps. UNFICYP was the first UN peace operation to install CCTV cameras to monitor sensitive hotspots along the "Green Line" in 2008 (Dorn, 2014). Reports on the safety and security of personnel in United Nations (UN) peace operations have advocated for greater use of CCTV in UN peace operations (see, e.g., Willmot et al., 2015).

It is important to note that drones, satellites, and CCTV complement but cannot substitute for thermal goggles, aerial reconnaissance using digital cameras, radars for ground and aerial surveillance and for subsurface mine and IED detection, remote-controlled robots for IED defusion, videoconferencing tools for peacekeepers' telehealth care and for liaising with headquarters, and other technologies for 21st century peacekeeping that are outside the scope of this paper. Moreover, digital technologies do not diminish the value of active in-person engagement with communities and other sources of peacekeeping intelligence, such as human intelligence and forensic analysis. Digital technologies can merely help acquire and analyze data

efficiently. Their utility ultimately depends on the availability of personnel with technical and analytic expertise. The next section provides more detail on harnessing remote imagery as a form of data.

Artificial Intelligence

Even the best data acquired with the help of sophisticated digital technologies or by other means is only as valuable to UN peace operations as the analysis that draws inferences from the raw data. A recent study warned of a "growing gap between the enormous quantities of imagery acquired from UAVs and other camera feeds … and the rudimentary ability for the world organization to analyze the imagery" (Dorn and Giardullo 2020: 4). Another report warns that parts of the UN peace and security infrastructure already appear to be suffering from "sensory overload" and that they "lack the capacity to sift through the massive amounts of information generated by social media analysis and data capture technologies" (Pauwels, 2020: 4). Cutting-edge software (e.g., for pattern recognition, change/anomaly detection) and staff trained to use it are needed to make sense of the data gained from digital technologies (*Ibid*.). Artificial intelligence can help achieve this task.

Artificial intelligence can support UN peace operations in five specific ways. First, it can help optimize and automate administrative and logistical processes, thereby enhancing the efficiency and effectiveness of UN missions (Pasligh, 2019). For instance, natural language processing software helps with translations that facilitate communication with the local population and between UN staff members (Ibid.). AI-based virtual tactical training could help prepare UN peacekeepers to implement complex mandates in difficult settings while also mitigating the risk of casualties (see, e.g., Cil and Mala, 2010).

Second, machine learning techniques can be used to anticipate future conflict (Guo et al., 2018). They have been employed to predict local violence in Liberia (Blair et al., 2017), combat violence events in Africa (Perry, 2013), and the outbreak of civil war around the world (Colaresi and Mahmood, 2017). Moreover, natural language processing software can be used to analyze radio and social media data in order to assess risks of future conflict. For instance, a UN Global Pulse lab relied on natural language processing to analyze radio shows in Uganda in order to assess social tensions (Hidalgo-Sanchis, 2018). In Somalia, a UN Global Pulse lab analyzed fake news on Facebook, fake Facebook posts, and fake Facebook groups as well as trending topics and thereby improved situational awareness of the social media terrain (UN Global Pulse, 2018).

Third, machine learning can be used to more effectively respond to ongoing or impending crises. For example, deep learning — a more complex method of machine learning that uses "neural networks" to "learn" a particular set of tasks — has been used to identify the size and location of refugee camps in Syria, for improved humanitarian responses, and to prevent overcrowding (Lu et al., 2020). The destruction of cities caused by civil wars and natural disasters can, similarly, be used to better allocate funds aimed at rebuilding (Lubin and Saleem, 2019). Other

research has used machine learning to predict patterns of conflict-related displacement in Syria and Yemen, which could help to guide resources (Huynh and Basu 2019).

Fourth, AI can assist with the analysis of video and remote sensing data gathered through satellites, drones, and CCTV. Specifically, AI can detect humans, vehicles, objects, events, and patterns in videos. Recent applications range from real-time analysis of crowd size and behavior (e.g., direction of movement and interactions in the crowd) to automatic licence plate recognition. AI can also send alerts, e.g., when it determines that a human is present on a live video taken in a restricted area or when it notices a cloud of smoke from a fire or explosion. Such uses require relatively simple algorithms that are programmed to sound the alarm when specific conditions are met. More complex, self-learning software can be instructed to learn patterns of 'normal' behavior by watching video or remote sensing data and to recognize events that depart from these patterns. For instance, such behavioral analytics recognizes a break in patterns - and can sound the alarm - if a street that is usually empty at night is suddenly crowded or used by a convoy of trucks.

Fifth, AI can help detect deepfakes. Advances in machine learning and computer graphics make it easier to convincingly manipulate audio and video recordings, and UN peacekeepers have to anticipate that conflict parties will increasingly use deepfakes in psychological operations, propaganda, and diplomacy in the area of operation. In turn, AI also informs cutting-edge software programs to detect deepfakes (Mirsky and Lee, 2021; Nguyen et al., 2020; Agarwal *et al*., 2020). Swift advances in technologies to produce deepfakes require constant efforts to enhance the sophistication of AI-based approaches to detect them.

Harnessing the possibilities of AI for these tasks requires both access to high-quality data and expertise in relevant methods. The tools necessary will vary depending on the goal, but often share certain common features. Translating images, text, or otherwise unstructured information into usable data typically requires a classification method, often done through machine learning. This, in turn, usually necessitates a large, manually classified set of "training data" that can be used to build effective models. Developing this training data can be labor intensive, though it can often be crowdsourced through platforms like Figure8. Even using pre-existing data sources, effective prediction requires knowledge of machine learning methods and validation techniques (Bazzi et al., 2019). To fully harness these tools, the UN could build in-house expertise or partner with external experts.

UN peacekeepers could fruitfully apply machine learning techniques to the analysis of the fine-grained data gathered in the SAGE system (Duursma and Karsrud, 2019). Such analyses could provide insights for early warning and conflict prediction, and they could potentially benefit planning and resource allocation at the strategic and tactical level. Of course, the challenge of successfully translating early warning into timely action is beyond the realm of artificial intelligence.

Emerging Opportunities

The rapid progress of digital technologies will open up a number of potential opportunities for tomorrow's UN peacekeepers. This section will focus on a single example: body-worn cameras. This technology could potentially strengthen accountability, command and control, and UN peacekeepers' safety and security in the field. These cameras could also serve as useful aids in military training (Kenny, 2015) for peacekeeping operations. Data from body-worn cameras could also be used for real-time conflict analysis. Finally, they might enable UN peace operations to present videographic evidence in order to counter public criticism and to dispel inaccurate portrayals of blue helmet conduct.

Studies on the use of body-worn cameras in law enforcement provide some insights into their effect. Several impact evaluations show that officers who wore cameras received fewer complaints than those without this technology, which is consistent with the notion that monitoring of officers alters their behavior (see, Lum *et al.* 2019). At the same time, there is some evidence that officers become more proactive and initiate more community contacts and field encounters when they are equipped with this technology (Headley *et al.*, 2017; Ready and Young, 2015; Wallace *et al.*, 2018). The impact of body-worn-cameras depends on whether officers are required to turn them on or have discretion over doing so, whether they must review the videos before they write incident reports or not, and on whether videos may be viewed by people involved in an incident and by the general public (Van Ness, 2020).

At this point, we do not know whether the effect of body-worn cameras in UN peacekeeping would be similar to that observed in law enforcement or not. Potentially, they might help to shorten peacekeepers' response times and improve the appropriateness of their response. However, there is a risk that video feeds could be hacked and used either to plan attacks on peacekeepers or to spread anti-UN propaganda. These risks would have to be addressed before this technology can be adopted by UN peace operations. Moreover, data management techniques that regulate video redaction, retention, deletion, and access are needed to safeguard privacy rights of individuals who are recorded (see, e.g., Lin, 2015). A pilot study with a rigorous impact assessment could provide valuable insights.

Conclusion

As UN peace operations increasingly draw on digital technologies to gather and analyze information – and also access data generated by other users of digital technologies like social media and cell phones – they have to reflect on the cost and benefit of sharing this wealth of information beyond the mission. Moreover, the UN Security Council may wish to consider how this information can enrich its own deliberations and to what extent information-sharing should feature in peacekeeping mandates. The dissemination of information such as drones or satellite images beyond the mission serves three purposes. First, providing some raw data to the UN Security Council can help the latter achieve a common interpretation of events in the peace operation's area of operation and may inform the discussions that lead to the Council's decisions (Dorn and Giardullo, 2020).

Second, sharing some of this data with the UN country team and with humanitarian aid providers improves the speed and efficiency of the latter's response to humanitarian crises (Dorn and Giardullo, 2020). In this context, the UN Secretary-General's Data Strategy (2020: 4) established "a culture that values openness and sharing by default" as one of the organization's goals. The Humanitarian Data Exchange, a platform spearheaded by OCHA that enables the UN system, NGOs, governments, and universities to improve data sharing during emergencies, helps turn this aspiration into practice.

Finally, sharing fine-grained (but anonymized) conflict event data with researchers can dramatically improve our collective understanding of contemporary armed conflict and its resolution. More than a decade ago, systematically compiled conflict event data on Afghanistan and Iraq was made available (in anonymized and declassified format) to researchers. This resource inspired a large body of empirical scholarship on contemporary armed conflict with substantial policy implications (e.g., Berman *et al*. 2018). By sharing more fine-grained and anonymized event data with researchers, the UN could facilitate rigorous studies and obtain hard evidence on the effectiveness and efficacy of UN peace operations at a time at which many member states face resource scarcity and competing priorities.

References

Ackerman, Spencer. 2012. "Syrian Rebels Put Captured Iranian Drones on YouTube." *Wired*, August 16.

Adorama. 2020. "What Are Drone Thermal Imaging Cameras Used For?" February 10.

Africa Center for Strategic Studies. 2020. *A Light in Libya's Fog of Disinformation*.

AFP. 2020. "Taliban Rigging Drones to Drop Bombs, Afghan Spy Chief Says." November 23.

Agarwal, Shruti, Hany Farid, Ohad Fried, and Maneesh Agrawala. 2020. "Detecting Deep-Fake Videos from Phoneme-Viseme Mismatches". *Working Paper*.

Al Jazeera. 2020. "Sri Lanka: Facebook apologises for role in 2018 anti-Muslim riots." May 13.

Al Jazeera. 2021. "Saudi Arabia says it foiled Houthi drone attack on Abha airport." February 13.

Alami, Mona. 2018. *Russia's disinformation campaign has changed how we see Syria*. The Atlantic Council.

Alsema, Adriaan. 2016. "Colombia's most important vote in recent history marred by disinformation." *Colombia Reports*. September 6.

Amnesty International. 2015. "Nigeria: Satellite images show horrific scale of Boko Haram attack on Baga." *Amnesty International*. January 15.

Anderson, David and Emma Lochery. 2008. "Violence and Exodus in Kenya's Rift Valley, 2008: Predictable and Preventable?" *Journal of Eastern African Studies* 2(2): 328-343.

Ansari, Mohd, M. B. Aziz, M. O. Siddiqui, H. Mehra, and K. P. Singh. 2020. "Analysis of Political Sentiment Orientations on Twitter." *Procedia Computer Science* 167: 1821–1828.

Arce, Alberto. 2015. "In frightened Mexico town, a mob kills 2 young pollsters." *San Diego Union Tribune*, October 22.

Atlantic Council. 2019. *Digital Forensic Research Lab explores disinformation campaigns in the Middle East*.

Avtar, Ram, Asma Kouser, Ashwani Kumar, Deepak Singh, Prakhar Misra, Ankita Gupta, Ali P. Yunus, Pankaj Kumar, Brian Alan Johnson, Rajarshi Dasgupta, Netrananda Sahu, and Andi Besse Rimba. 2021. "Remote Sensing for International Peace and Security: Its Role and Implications." *Remote Sensing* 13: 439.

Barrie, Christopher and Alexandra A. Siegel. 2021. "Kingdom of Trolls: Influence Operations in the Saudi Twittersphere." *Working Paper*.

Bazzi, Samuel, Robert A. Blair, Christopher Blattman, Oendrila Dube, Matthew Gudgeon, and Richard Merton Peck. 2019. "The Promise and Pitfalls of Conflict Prediction: Evidence from Colombia and Indonesia." NBER Working Paper.

BBC. 2012. "Afghan Taliban use phones for propaganda." 30 March.

BBC. 2021. "Myanmar coup: Internet shutdown as crowds protest against military." 6 February.

Bengtsson, Linus, Xin Lu, Anna Thorson, Richard Garfield, Johan von Schreeb. 2011. "Improved Response to Disasters and Outbreaks by Tracking Population Movements with Mobile Phone Network Data: A Post-Earthquake Geospatial Study in Haiti." *PLOS Medicine* 8(8).

Berman, Eli, Joseph Felter, and Jacob Shapiro. 2018. *Small Wars, Big Data: The Information Revolution in Modern Conflict*. Princeton: Princeton University Press.

Birnback, Nick. 2019. "Under the Blue Flag: Leadership and Strategic Communications in UN Peace Operations." *International Forum for the Challenges of Peace Operations Policy Brief* 4.

Bittner, Christian, Boris Michel, and Cate Turk. 2016. "Turning the Spotlight on the Crowd: Examining the Participatory Ethics and Practices of Crisis Mapping." *ACME: An International Journal for Critical Geographies* 15(1): 207-229.

Blair, Graeme, Christopher Blattman, and Alexandra Hartman. 2017. "Predicting local violence: Evidence from a panel survey in Liberia." *Journal of Peace Research* 54(2): 298-312.

Blair, Graeme, Kosuke Imai, and Jason Lyall. 2014. "Comparing and Combining List and Endorsement Experiments: Evidence from Afghanistan." *American Journal of Political Science* 58(4): 1043-1063.

Blakely, Rhys. 2005. "Terrorists threaten Iraq mobile operators." *The Times*, July 22.

Blyth, Mike. 2009. "Missions look to SMS in Nigeria." *Kiwanja.net* (blog). June 4.

Bodine-Baron, Elizabeth, Todd C. Helmus, Madeline Magnuson, and Zev Winkelman. 2016. *Examining ISIS Support and Opposition Networks on Twitter*. RAND.

Brandt, Adam. 2020. "Accuracy of satellite-derived estimates of flaring volume for offshore oil and gas operations in nine countries." *Environmental Research Communications* 2(5).

Bulos, Nabih. 2019. "Libya's two wars: One on the battlefield and one on Facebook." *LA Times*, June 17.

Cahlan, Sarah. 2020. "How misinformation helped spark an attempted coup in Gabon." *Washington Post*. February 13.

Caragea, Cornelia, Nathan McNeese, Anuj Jaiswal, Greg Traylor, Hyun-Woo Kim, Prasenjit Mitra, Dinghao Wu, Andrea H. Tapia, Lee Giles, Bernard J. Jansen, and John Yen. 2011. "Classifying Text Messages for the Haiti Earthquake." *Proceedings of the 8th International ISCRAM Conference*.

CBS News. 2012. "Syria regime tells public in mass-text message that it's "game over" for rebels." September 27.

Center for Strategic and International Studies (CSIS). 2021. *Significant Cyber Incidents*.

Chen, Brian X. and Kevin Roose. 2021. "Are Private Messaging Apps the Next Misinformation Hot Spot?" *New York Times*, February 3.

Chen, Emily, Kristina Lerman, and Emilio Ferrara. 2020. "Tracking Social Media Discourse About the COVID-19 Pandemic: Development of a Public Coronavirus Twitter Data Set." *JMIR Public Health and Surveillance* 6(2): 1-9.

Christensen, Darin and Francisco Garfias.2018. "Can You Hear Me Now? How Communication Technology Affects Protest and Repression", *Quarterly Journal of Political Science* 13(1): 89-117.

Chulov, Martin. 2020. "How Syria's disinformation wards destroyed the co-founder of the White Helmets." *The Guardian*. October 27.

Cil, Ibrahim and Murat Mala. 2010. "A multi-agent architecture for modelling and simulation of small military unit combat in asymmetric warfare." *Expert Systems with Applications* 37(2): 1331-1343.

Cohen, Jared. 2015. "Digital counterinsurgency: How to marginalize the Islamic State online." *Foreign Affairs* 94 (6): 52–58.

Colaresi, Michael and Zuhaib Mahmood. 2017. "Do the robot: Lessons from machine learning to improve conflict forecasting." *Journal of Peace Research* 54(2): 193-214.

Conde, Carlos H. 2020. "Philippine Activists Charged with Sedition, 'Fake News.'" Human Rights Watch.

Conflict Armament Research. 2016. *Tracing the Supply of Components Used in Islamic State IEDs*.

Congressional Research Service. 2020. *Defense Primer: U.S. Policy on Lethal Autonomous Weapon Systems.*

Convergne, Elodie and Michael R. Snyder. 2015a. "Making Maps to Make Peace: Geospatial Technology as a Tool for UN Peacekeeping." *International Peacekeeping* 22(5): 565-586.

--. 2015b. "Geospatial Technology as a Conflict Prevention and Management Tool in UN Peacekeeping." International Peace Institute and French Ministry of Defense.

Corera, Gordon. 2020. "ISIS 'still evading detection on Facebook', report says." *BBC*, July 13.

Dette, Rahel. 2018. "Do No Digital Harm: Mitigating Technology Risks in Humanitarian Contexts." In *Technology for Development* (eds. S. Hostettler, S. Najih Besson, JC Bolay). UNESCO.

DFRLab. 2021. "Inauthentic Instagram accounts with synthetic faces target Navalny protests." The Atlantic Council.

DFRLab. 2020. "New accounts, old tricks: pro-Maduro regime propaganda on Twitter." The Atlantic Council.

Dharmapuri, Sahana. 2017. "Social media and peace operations." *Our secure future* (blog). April 7.

Do, Quy-Toan, Jacob N. Shapiro, Christopher D. Elvidge, Mohamed Abdel-Jelil, Daniel P. Ahn, Kimberly Baugh, Jamie Hansen-Lewis, Mikhail Zhizhin, and Morgan D. Bazilian. 2018. "Terrorism, geopolitics, and oil security: Using remote sensing to estimate oil

production of the Islamic State." *Energy Research & Social Science* 44: 411-418.

Dorn, Walter. 2011. *Keeping Watch: Monitoring, Technology and Innovation in UN Peace Operations*. United Nations University.

Dorn, Walter and Cono Giardullo. 2020. "Analysis for Peace: The Evolving Data Tools of UN and OSCE Field Operations." *Security and Human Rights* 30: 1-12.

Dragu, Tiberiu and Yonatan Lupu. 2020. "Digital Authoritarianism and the Future of Human Rights." *International Organization* (Forthcoming).

Duursma, Allard and John Karlsrud. 2018. "Predictive Peacekeeping: Strengthening Predictive Analysis in UN Peace Operations." *Stability: International Journal of Security & Development* 8(1): 1-19.

Dyndal, G. Lage, Arne Berntsen, and S. Redse-Johansen. 2017. "Autonomous military drones: No longer science fiction." NATO.

Engel, Richard. 2012. "Myth vs truth in the Syrian conflict." *NBC News*, July 25.

Europol. 2020. "Spain takes down terrorist cell recruiting online for the so-called Islamic State." Press Release, 30 October.

Feldstein, Steven. 2019a. "The Global Expansion of AI Surveillance." *Carnegie Endowment for International Peace*. 30(1): 40-52.

--. 2019b. "The Road to Digital Unfreedom: How Artificial Intelligence is Reshaping Repression." *Journal of Democracy* 30(1): 40-52.

Fergusson, Leopoldo and Carlos Molina. 2020. Facebook Causes Protests. *Working Paper.*

Food and Agriculture Organization of the United Nations. 2018. *E-Agriculture in Action: Drones for Agriculture*. Rome: FAO.

France24. 2021. "Uganda eases internet shutdown imposed over election." January 18.

FreedomHouse. 2017. *Freedom on the Net 2017: Manipulating Social Media to Undermine Democracy*.

Gagliardone, Iginio, Alisha Patel and Matti Pohjonen. 2014. "Mapping and Analysing Hate Speech Online: Opportunities and Challenges for Ethiopia." Addis Ababa University and University of Oxford.

Gallagher, Ryan. 2012. "Report: New Surveillance Malware Targeting Syrian Opposition." *Slate*, April 6.

Giada, Silvia, Tom de Groeve, Daniele Ehrlich, and P. Soille. 2003. "Information extraction from very high resolution satellite imagery over Lukole refugee camp, Tanzania." *International Journal of Remote Sensing* 24(22):4251-4266.

Gohdes, Anita R. 2015. "Pulling the Plug: Network Disruptions and Violence in Civil Conflict." *Journal of Peace Research*. 52(2): 3520-367.

Green, John. 2020. "Managing Misinformation to Build Peace in South Sudan." The Sentinel Project.

Greenberg, Karen J. (2016). "Counter-Radicalization via the Internet." *The ANNALS of the American Academy of Political and Social Science* 668(1): 165-179

Gross, Doug. 2012. "Syria caused Internet blackout, security firm says." *CNN*, December 3.

Grossman, Nicholas. 2018a. *Drones and Terrorism: AsymmetricWarfare and the Threat to Global Security*. Bloomsbury: London.

--. 2018b. "Are drones the new terrorist weapon? Someone tried to kill Venezuela's president with one. *Washington Post*, August 10.

Grossman, Shelby, Khadija H., Renée DiResta, Tara Kheradpir, and Carly Miller. 2020. *Blame it on Iran, Qatar, and Turkey: An analysis of a Twitter and Facebook operation linked to Egypt, the UAE, and Saudi Arabia*. The Stanford Internet Observatory.

Guo, Weisi, Kristian Gleditsch, and Alan Wilson. 2018. "Retool AI to forecast and limit wars". *Nature* 562: 331-333.

Hanrahan, Jake. 2019. "3D-printed guns are back, and this time they are unstoppable." *Wired*, 20 May.

Hansen, Annika. 2020. "Digital technologies in peace operations." *About Intel* (blog). March 16.

Harwell, Derw and Eva Dou. 2020. "Hawei tested AI software that could recognize Uighur minorities and alert police, report says." *Washington Post*, December 8.

Headley, Andrea, Rob T. Guerette, and Auzeen Shariati. 2017. "A field experiment of the impact of body-worn cameras (BWCs) on police officer behavior and perceptions." *Journal of Criminal Justice* 53: 102-109.

Henderson, Vernon, Adam Storeygard, and David Weil. 2012. "Measuring Economic Growth from Outer Space." *American Economic Review* 102(2): 994-1028.

Henichs, Kat. 2013. "Effects of Drone Strikes on Humanitarian Aid." The Borgen Project.

Henigson, Harley. 2020. *Community Engagement in UN Peacekeeping Operations: A People-Centered Approach to Protecting Civilians*. New York: International Peace Institute.

Hidalgo-Sanchis, Paula. 2018. "Using Big Data and AI to Support Peace and Security Efforts in Africa." *UN Global Pulse*. December 26.

Horowitz, Michael C., Joshua A. Schwart, and Matthew Fuhrmann. 2020. "China Has Made Drone Warfare Global." *Foreign Affairs*.

Human Rights Watch. 2020. *Stopping Killer Robots: Country Positions on Banning Fully Autonomous Weapons and Retaining Human Control*.

--. 2018. *China: Big Data Fuels Crackdown in Minority Region*.

--. 2020b. *Myanmar: End World's Longest Internet Shutdown*.

--. 2020c. *Cambodia: Covid-19 Spurs Bogus 'Fake News' Arrests*.

Huynh, Benjamin Q. and Sanjay Basu. 2019. "Forecasting Internally Displaced Population Migration Patterns in Syria and Yemen." *Disaster Medicine and Public Health Preparedness* 14(3): 302-307.

Insikt Group. 2019. *Yemeni War Emphasizes Importance of Internet Control in Statecraft and Conflict*. Recorded Future.

--. 2018. *Underlying Dimensions of Yemen's Civil War: Control of the Internet*. Recorded Future.

International Crisis Group. 2020. *Easing Cameroon's Ethno-political Tensions, On and Offline*. Africa Report No. 295.

--. International Crisis Group. 2017. *In the Shadow of "No": Peace after Colombia's Plebiscite*. Latin America & Caribbean Report No. 60.

Jamal, Amaney, Robert Keohane, David Romney, and Dustin Tingley. 2015. "Anti-Americanism and Anti-Interventionism in Arabic Twitter Discourses." *Perspectives on Politics* 13(1): 55-73.

Jenny, Joëlle, Rosi Greenberg, Vincent Lowney, and Guy Banim. 2018. "Peacemaking and new technologies: Dilemmas & options for mediators." *Mediation Practice Series* 8.

Jiang, Wei, Guijin He, Tengfei Long, and Huichan Liu. 2017. "Ongoing Conflict Makes Yemen Dark: From the Perspective of Nighttime Light." *Remote Sensing* 9(8): 798.

Jones, Benjamin T. and Eleanora Mattiacci. 2017. "Media as a Tool of Rebel Diplomacy." *British Journal of Political Science* 49(2): 739-761.

Jones, Bruce, Charles T. Call, Daniel Toubolets, and Jason Fritz. "Managing the New Threat Landscape: Adapting the Tools of International Peace and Security." *Brookings Institution*.

Judson, Jen. 2021. US Army taps industry for autonomous drones to resupply troops." *Defense News*, January 15.

Karlsrud, John. 2014. "Peacekeeping 4.0: Harnessing the Potential of Big Data, Social Media, and Cyber-technology." In: Jan-Frederik Kremer and Benedikt Müller (eds.), *Cyber Space and International Relations: Theory, Prospects and Challenges*. Heidelberg: Springer: 141-160.

Katz, Rita. 2010. "A Growing Frontier for Terrorist Groups: Unsuspecting Chat Apps." *Wired*, January 9.

Kemp, Simon. 2021. "Digital 2021 report series." *Datareportal*. 12 February.

--. 2020. "Digital 2020 report series." *Datareportal*. 12 February.

Kenny, Ryan. 2015. "Disruptive By Design: Body Cameras Could Be a Win for the Military." *Signal*. December 1.

Kerbey, A.J. 2016. "MONUSCO's Edge - Unmanned Aerial Systems." *MONUSCO*. June 23.

Khawaja, Asma Shakir and Khan, Asma Hussain. 2016. "Media Strategy of ISIS: An Analysis." *Strategic Studies*. 36(2): 104-121.

King, Gary, Jennifer Pan, and Margaret E. Roberts. 2013. "How censorship in China allows government criticism but silences collective expression." *American Political Science Review* 107(2): 326-343.

Koerner, Brenda. 2016. "Why ISIS Is Winning the Social Media War." *Wired*.

Kuo, Lily. 2016. "Mali is the latest African country to impose a social media blackout." *Quartz Africa*, August 19.

Lin, Richard. 2015. "Police Body Worn Cameras and Privacy: Retaining Benefits while Reducing Public Concerns." *Duke Law & Technology Review* 16: 346-365.

Lin-Greenberg, Eric and Theo Milonopolous. 2021. "Private Eye in the Sky: Emerging Technology and the Political Consequences of Eroding Government Secrecy." *Journal of Conflict Resolution* (Forthcoming).

Linzer, Isabel. 2019. "An Explainer for When the Internet Goes Down: What, Who, and Why?" FreeedomHouse.

Lu, Yan, Krzysztof Koperski, Chiman Kwan, and Jiang Li. 2020. "Deep Learning for Effective Refugee Tent Extraction Near Syria-Jordan Border." *IEEE Geoscience and Remote Sensing Letters*.

Lubin, A. and A. Saleem. 2019. "Remote sensing-based mapping of the destruction to Aleppo during the Syrian Civil War between 2011 and 2017." *Applied Geography* 108: 30-38.

Lum, Cynthia, Megan Stoltz, Christopher S. Koper, and J. Amber Scherer. 2019. "Research on body-worn cameras: What we know, what we need to know." *Criminology & Public Policy* 18(1): 93-118.

Manacorda, Marco and Andrewa Tesei. 2020. "Liberation Technology: Mobile Phones and Political Mobilization in Africa." *Econometrica* 88(2): 533-567.

Marelli, Massimo. 2020. *Hacking Humanitarians: moving towards a humanitarian cybersecurity strategy*. ReliefWeb.

Masih, Niha, Shams Irfa, and Joanna Slater. 2019. "India's Internet shutdown in Kashmir is the longest ever in democracy." *Washington Post*, December 16.

McPherson, Poppy. 2018. "Exclusive: Fake photos in Myanmar army's 'True News' book on the Rohingya crisis." *Reuters*, December 28.

Médecins Sans Frontièrs. 2020. "Misinformation about COVID-19 creates greater risks in Democratic Republic of Congo." May 5.

Miles, Tom. 2019. "Myanmar blackout may cover for gross human rights violations: UN investigator." *Reuters*, June 24.

Mirsky, Yisroel and Wenke Lee. 2021. "The Creation and Detection of Deepfakes: A Survey." *ACM Computing Surveys* 54(1).

Mitts, Tamar. 2019. "From Isolation to Radicalization: Anti-Muslim Hostility and Support for ISIS in the West." *American Political Science Review* 113 (1): 173-194.

Morozov, Evgeny. *The Net Delusion: The Dark Side of Internet Freedom*. PublicAffairs: New York.

Netblocks. 2020. "Social media restricted in Mali amid protests against president." July 10.

--. 2018. "Mali elections marred by internet disruptions." August 16.

Nguyen, Thanh Thi, Cuong Nguyen, Dung Tien Nguyen, Duc Thanh Nguyen, and Saeid Nahavandi. 2020. "Deep Learning for Deepfakes Creation and Detection: A Survey." *arXiv* 1909.11573.

Pamuck, Humeyra and Phil Stewart. 2020. "Exclusive: U.S. halts secretive drone program with Turkey over Syria incursion." *Reuters*, February 5.

Peeva, Aleksandra. 2021. "Now Available: New Drone Technology for Radiological Monitoring in Emergency Situations." *IAEA*. February 1.

Poetranto, Irene. 2015. "Canadian Company Censors Internet in War Zone for Yemeni Rebel Group Targeted by UN Sanctions." The Citizen Lab.

Martineau, Paris. 2019. "Turkish ISP Blocks Social Media Sites Near Syrian Border." *Wired*, October 11.

Mozur, Paul. 2019. "One Month, 500,000 Face Scans: How China is Using A.I. to Profile a Minority." *New York Times*, April 14.

Office of the United Nations High Commissioner for Human Rights. 2019. "Preventing incitement to hatred and violence in the Central African Republic."

Overton, Iain, Jennifer Dathan, Charlie Winter, Joe Whittaker, Roger Davis, and Hugo Kaaman. 2017. *Improvised Explosive Device (IED) Monitor 2017*. Action on Armed Violence.

Owuor, Victor and Scott Wisor. 2014. *The Role of Kenya's Private Sector in Peacebuilding: The Case of the 2013 Election Cycle*. Broomfield: One Earth Future Foundation.

Pasligh, Hendrik. 2019. "The Application of Artificial Intelligence for Peacekeeping." *Security Distillery* (blog). July 17.

Paul, Michael and Mark Dredze. 2011. "You Are What You Tweet: Analyzing Twitter for Public Health." *Proceedings of the Fifth International AAAI Conference on Weblogs and Social Media*: 265-272.

Pauwels, Eleonore. 2020. "Artificial Intelligence and Data Capture Technologies in Violence and Conflict Prevention Opportunities and Challenges for the International Community." *Global Center on Cooperative Security*.

Perrigo, Billy. 2019. "Facebook Says It's Removing More Hate Speech Than Ever Before. But There's a Catch." *Time*, November 13.

Perry, Chris. 2013. "Machine Learning and Conflict Prediction: A Use Case." *Stability: International Journal of Security & Development* 2(3): 1-18.

Peterson, Scott. 2012. "In Aleppo, Syrian rebels wage war – with an Internet connection." *Christian Science Monitor*, October 25.

Pew Research. 2012. "Global Opinion of Obama Slips, International Policies Faulted."

Pierskalla, Jan H. and Florian M. Hollenbach. 2013. "Technology and Collective Action: The Effect of Cell Phone Coverage on Political Violence in Africa." *American Political Science Review* 107(2): 207-224.

Porter, Jon. 2020. "WhatsApp says its forwarding limits have cut the spread of viral messages by 70 percent." *The Verge*, April 27.

Puig Larrauri, Helena. 2012. "Conflict sensitive crowdsourcing." *Let them talk* (blog). 5 July.

Ready, Justin and Jacob Young. 2015. "The impact of on-officer video cameras on police–citizen contacts: findings from a controlled experiment in Mesa, AZ." *Journal of Experimental Criminology* 11: 445-458.

Reisinger, Don. 2018. "Twitter Has Suspended 1.2 Million Terrorist Accounts Sinxe 2015." *Fortune*, April 5.

Reuters. 2020. "Venezuela wields a powerful 'hate' law to silence Maduro's remaining foes."

Rigterink, Anouk. 2021. "The Wane of Command: Evidence on Drone Strikes and Control within Terrorist Organizations." *American Political Science Review* 115(1): 31-50.

Roose, Kevin and Paul Mozur. 2018. "Zuckerberg Was Called Out Over Myanmar Violence. Here's His Apology." *New York Times*, April 9.

Rumi, Raza. 2015. "A Drone Killed My Friend, Warren Weinstein." *Foreign Policy*, April 30.

Safi, Michael. 2019. "Are drone swarms the future of aerial warfare?" *The Guardian*, December 4.

Satellite Sentinel Project. 2011. *Cover-Up: New Evidence of Three Mass Graves in South Kordofan*. Washington: Satellite Sentinel Project.

Schaefer, Ben. 2018. "The Cyber Party of God: How Hezbollah Could Transform Cyberterrorism." *Georgetown Security Studies Review*.

Schreiner, Tanja. 2018. "Information, Opinion, or Rumor? The Role of Twitter During the Post-Electoral Crisis in Côte d'Ivoire." *Social Media + Society* 4(1): 1-16.

Shapiro, Jacob N. and David A. Siegel. 2015. "Coordination and security: How mobile communications affect insurgency." *Journal of Peace Research* 52(3): 312-322.

Shapiro, Jacob N. and Nils B. Wedimann. 2015. "Is the Phone Mightier than the Sword? Cellphones and Insurgent Violence in Iraq." *International Organization* 69(2): 247-274.

Shaver, Andrew and Jacob N. Shapiro. Forthcoming. "The Effect of Civilian Casualties on Wartime Informing: New Evidence from Iraq." *Journal of Conflict Resolution*.

Shoker, Sarah and Ramy Shoker. 2020. "Using Artificial Intelligence to Predict Internet Shutdowns." *International Policy Ideas Challenge*.

Siegel, Alexandra A. and Vivienne Badaan. 2020. "#No2Sectarianism: Experimental Approaches to Reducing Sectarian Hate Speech Online." *American Political Science Review* 114 (3): 837-855.

Siegel, Alexandra A. and Joshua A. Tucker. 2018. "The Islamic State's information warfare: Measuring the success of ISIS' online strategy." *Journal of Language and Politics* 17(2): 258-280.

Slisco, Aila. 2020. "What are Ghost Guns? Senate Dems Introduce Bill Regulating Untraceable 3D-Printed Weapons." *Newsweek*, May 14.

Smith, Hugh. 1994. "Intelligence and UN Peacekeeping." *Survival* 36(3): 174-192.

Smith, Troy D., Trevor Johnston, and J. Luke Irwin. 2018. "Downloadable Guns and Other 3-D Printing Security Threats. *TheRANDBlog*, 31 July.

Steckelberg, Aaron. 2018. "The challenges of regulating 3-D-printed guns." *Washington Post*, August 20.

Steinert-Threlkeld, Zachary C., Delia Mocanu, Alessandro Vespignani, and James Fowler. 2015. "Online social networks and offline protest." *EPJ Data Science* 4 (19): 1-9.

Stevenson, Alexandra. 2018. "Facebook Admits It Was Used to Incite Violence in Myanmar." *New York Times*, November 6.

Stewart, Phil. 2015. "Russia starts Syria drone surveillance missions: U.S. officials." *Reuters*, September 21.

Sultan, Zainab. 2019. "Why the press struggles to cover the war in Yemen." *Columbia Journalism Review*, September 2.

Taub, Amanda and Max Fisher. 2018. "Where Countries are Tinderboxes and Facebook Is a Match." *New York Times*, April 21.

The New Humanitarian. 2011. "How online mapping helped crisis response." *The New Humanitarian*. May 12.

Times of India. 2020. "Coronavirus myth vs. fact: WhatsApp forward claiming turmeric and black pepper home remedy to cure COVID-19 is fake." July 16.

United Nations Global Pulse. 2018. *Experimenting with Big Data and Artificial Intelligence to Support Peace and Security*. Pulse Lab Kampala.

United Nations International Children's Emergency Fund. 2018. "Child given world's first drone-delivered vaccine in Vanuatu - UNICEF." *UNICEF*. December 18.

United Nations News. 2013. "International community must heed Pakistan's concerns over drones, says UN expert." March 15.

United Nations Office for Training and Research (UNITAR) - Satellite Analysis and Applied Research (UNOSAT). 2014. *Four Years of Human Suffering: The Syria Conflict as Observed Through Satellite Imagery*. UNITAR-UNOSAT.

United Nations Office on Genocide Prevention and the Responsibility to Protect. 2017. *Plan of Action for Religious Leaders and Actors to Prevent Incitement to Violence that Could Lead to Atrocity Crimes*.

United Nations Secretary-General. 2020. *Data Strategy of the Secretary-General for Action by Everyone, Everywhere with Insight, Impact and Integrity (2020-2022)*. United Nations.

Vaccari, Cristian and Andrew Chadwick. 2020. "Deepfakes and Disinformation: Exploring the Impact of Synthetic Political Video on Deception, Uncertainty, and Trust in News." *Social Media + Society* 6(1): 1-13.

Van der Windt, Peter and Macartan Humphreys. 2016. "Crowdseeding in Eastern Congo: Using Cell Phones to Collect Conflict Events Data in Real Time." *Journal of Conflict Resolution* 60(4): 748-781.

Van Ness, Lindsay. 2020. "Body Cameras May Not Be the Easy Answer Everyone Was Looking For." *Stateline* (blog). January 14.

Wallace, Danielle, Michael White, Janne Gaub, and Natalie Todak. 2018. "Body-worn cameras as a potential source of depolicing: Testing for camera-induced passivity." *Criminology* 56(3): 481-509.

Wardle, Hannah and Hossein Derakhshan. 2017. *Information disorder: Toward an interdisciplinary framework for research and policy making.* Council of Europe.

Warofka, Alex. 2018. "An Independent Assessment of the Human Rights Impact of Facebook in Myanmar." About.fb.com, November 5.

Wells, Georgia. 2019. "Islamic State Turns to Teen-Friendly TikTok, Adoring Pots with Pink Hearts." *Wall Street Journal*, October 21.

Warzel, Charlie and Stuart A. Thompson. 2019. "How Your Phone Betrays Democracy." *New York Times*, December 21.

Weidmann, Nils B. 2016. "A closer look at reporting bias in conflict event data." *American Journal of Political Science* 60(1): 206-218.

Woolley, Samuel. 2020a. "Encrypted messaging apps are the future of propaganda." *Brookings Institution*.

--. 2020b. "Political operatives are targeting propaganda by location." *Brookings Institution*.

World Bank. 2020. "World Bank Statement on Lebanon."

World Bank. 2021. "World Development Indicators."

World Food Program. 2021. "WFP boosts global co-operation on humanitarian drone use." February 4.

Yang, Shihao, Samuel Kou, Fred Lu, John Brownstein, Nicholas Brooke, and Mauricio Santillana. 2017. "Advances in using Internet searches to track dengue." *PLoS Computational Medicine* 13(7): 1-14.

Zeitzoff, Thomas. 2017. "How Social Media is Changing Conflict." *Journal of Conflict Resolution* 61(9): 1970-1991.

--. 2011. "Using Social Media to Measure Conflict Dynamics: An Application to the 2008–2009 Gaza Conflict." *Journal of Conflict Resolution* 55(6): 938-969.

Zetter, Kim. 2020. "How Cops Can Secretly Track Your Phone." *The Intercept*, July 31.

Ziegler, James. 2009. "Improvised explosive device (IED) counter-measures in Iraq." *IEEE International Reliability Physics Symposium*.