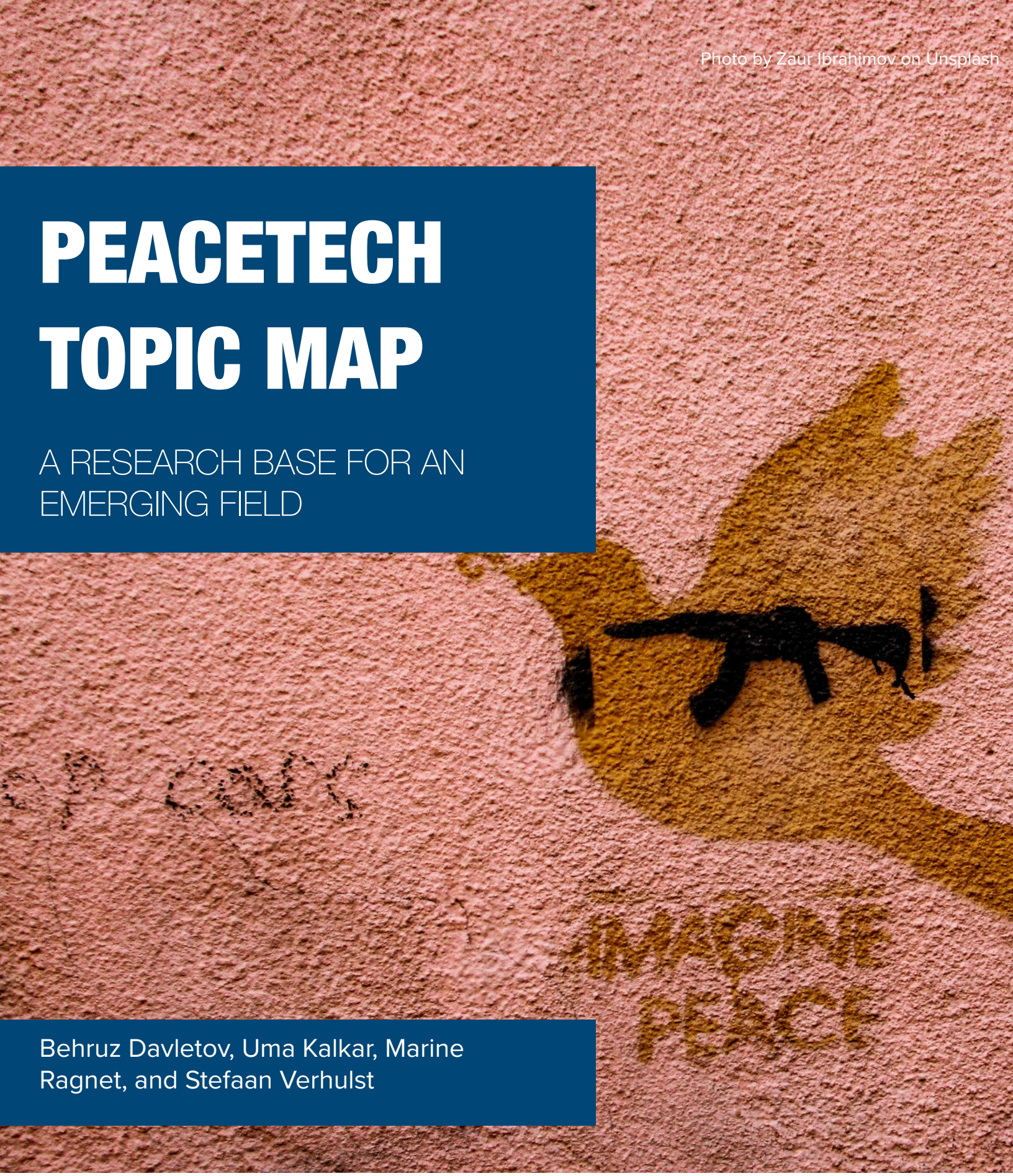

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PEACETECH TOPIC MAP

A RESEARCH BASE FOR AN EMERGING FIELD

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ACKNOWLEDGEMENTS

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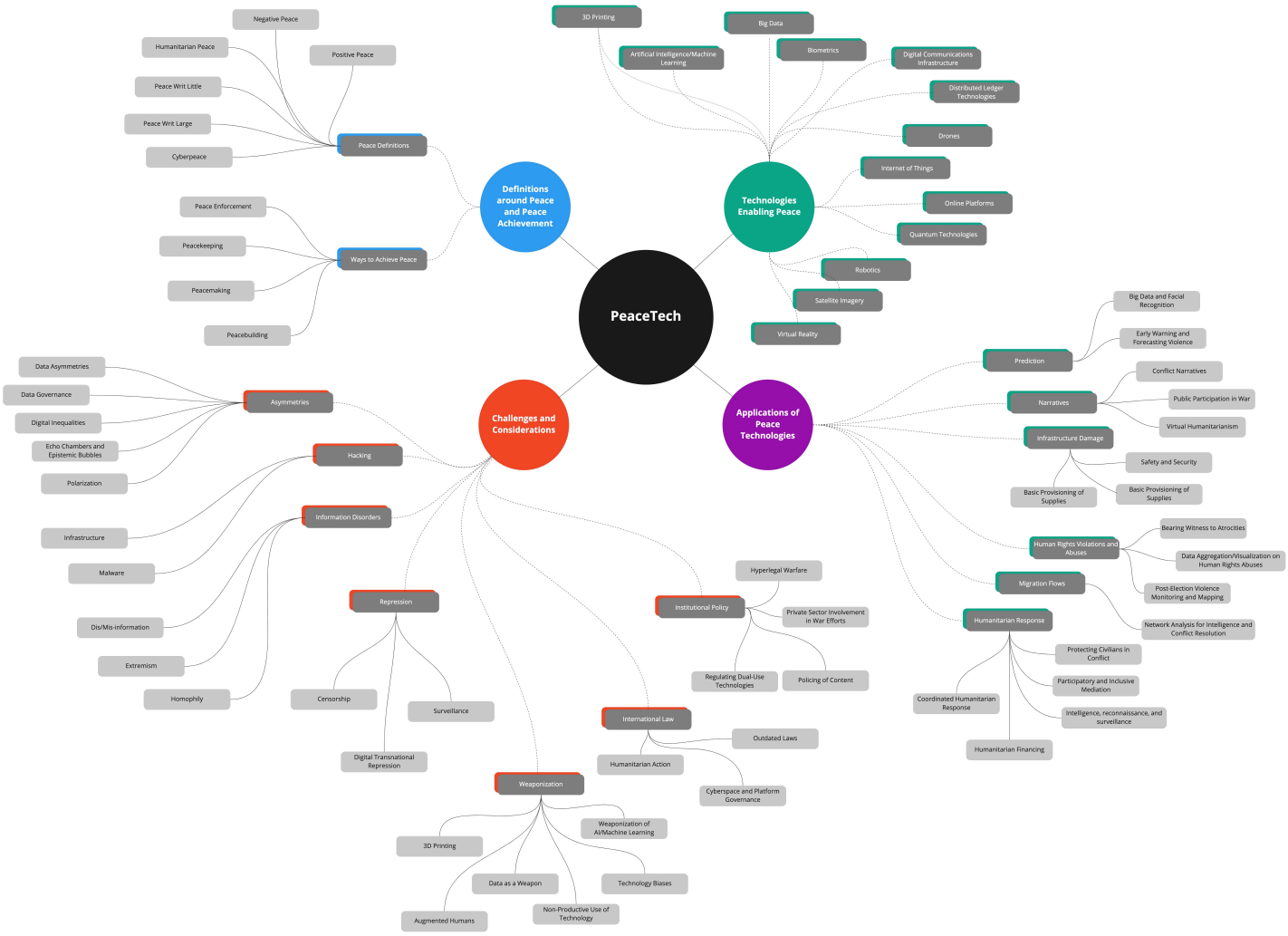

Visual representation of peace tech topic map. An expanded version is available on Miro.

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ABSTRACT

Technologies have, for centuries, been used for war and conquest. The use of technologies for peace, however, is a fairly new concept. Co-option of other technologies not primarily designed for peace efforts and the creation of specific tools for peace makes the 'PeaceTech' field an emerging yet confusing space. Indeed, technologies can be a strong magnifier of peace, amplifying and accelerating efforts to implement peacebuilding initiatives by offering new and innovative ways to address violence and conflict. Yet if misused, technology can also become a catalyst for division and brutality. Below we present an overview of the state of modern and emerging peace technologies, categorized by the technologies that enable peace, use case applications of PeaceTech, and challenges and risks posed by PeaceTech. This topic map was produced by The Governance Lab (The GovLab) using its R-Search Methodology, a research methodology that rapidly scans a problem space to identify the key constructs, challenges, and actors involved in a field to create a baseline for development and implementation of real policies around the subject matter.

SECTION I

INTRODUCTION

PEACETECH

PeaceTech is a new term that broadly refers to any type of technology that can be used to support **peace enforcement**, **peacekeeping**, **peacemaking**, and **peacebuilding** efforts. It looks to promote **positive peace** over short- and long-term horizons.[1]

PeaceTech includes everything from simple communication technologies, such as radios and social media, to more complex systems like satellite imagery and early warning systems. Most instances of PeaceTech are 'dual-use,' meaning that while these technologies have the potential to make a positive impact in the world, there is a risk that they could be misused and create harm. Hence, it is important to map PeaceTech to better understand how it is used and where the potential risks and benefits emerge.

PEACE

Before identifying the different modes of PeaceTech, it is important to define what is peace and how technologies can be used toward achieving it. However, there is not one agreed definition of peace.

Galtung (1969) was one of the first to introduce the concepts of different forms of peace, noting that there are two types of peace: *positive* and *negative*.[2] *Positive peace* can best be defined as the absence of personal, immediate violence and an absence of structural violence—i.e. peace with justice. In addition to the absence of violence, positive peace is also associated with many other desirable social characteristics, including better economic outcomes, measures of well-being, levels of inclusiveness, and environmental performance.[3] **PeaceTech aims to promote positive peace.**

Negative peace, on the other hand, is an absence of violence but does not necessarily require conflict resolution. The narrow definition of negative peace captures only a tiny subset of peace promotion activities; thus, it proves as too limited a framework to observe PeaceTech within.

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[1] *Global PeaceTech Hub*, n.d. https://www.globalpeacetech.org

[2] Galtung, Johan. "Violence, Peace, and Peace Research." *Journal of Peace Research* 6, no. 3 (1969): 167-191. https://www.jstor.org/stable/422690

[3] "Defining the Concept of Peace » Positive & Negative Peace." *Vision of Humanity*, n.d. https://www.visionofhumanity.org/defining-the-concept-of-peace

RELEVANT TYPES OF PEACE

- **Positive peace is a just peace, defined as the absence of personal, immediate violence, *and* an absence of structural violence—*peace with justice*.** In addition to the absence of violence, positive peace is also associated with many other desirable social characteristics, including better economic outcomes, measures of well-being, levels of inclusiveness, and environmental performance.

- **Negative peace is an absence of violence and therefore, does not necessarily require conflict resolution.** Measures of negative peace are, for example, the Global Peace Index developed by Vision for Humanity, which assesses conflict, militarization, deaths, and other instances of war absence to understand global (negative) peacefulness.

- **Humanitarian peace refers to protecting people—judged through the lens of personal dignity and human rights and needs.** However, political plays distort the operationalization of humanitarian peace and humanitarian intervention.

- **Peace writ little is sustainable peace at a local level.** Peace writ little is achieved through informal or formal organizations working on more effective mechanisms for resolving interpersonal disputes, such as land conflicts, issues regarding access or use of natural resources, or political, cultural, and/or ethnic tensions at a local level.

- **Peace writ large comprises broader changes in society as a whole.** It is achieved through wide-reaching, oftentimes "lofty and ambitious" goals of overarching peace.

- **Cyber peace acknowledges the use of technology in creating and waging conflict.** Modern-day warfare takes place in the physical and digital domains, with countries increasingly using computers to wage conflict and create instability against other states. The International Telecommunication Union (ITU), a United Nations (UN) agency for information technologies, has defined "cyber peace" as "a universal order of cyberspace" built on a "wholesome state of tranquility, the

WAYS TO ACHIEVE PEACE

In addition to having a better understanding of the definition of peace, it is important to also outline the differences in peace activity goals, which can be furthered through technologies, such as:

- **Peace Enforcement:** Peace enforcement refers to the use of military assets to enforce a peace against the will of the parties to a conflict when, for instance, a ceasefire has failed. This can lead to either positive or negative peace.

- **Peacekeeping:** Peacekeeping refers to the deployment of national or multinational forces to control and resolve an actual or potential armed conflict between or within states. Most peacekeeping operations are undertaken with the authorization of the United Nations. Peacekeeping goals are to actively ensure peace remains, typically through policing by an external military force. This can lead to either positive or negative peace.

- **Peacemaking:** Peacemaking activities seek peace between two consenting groups via techniques such as mediation or reconciliation, and are facilitated with or without external actors. This generally includes measures to address conflicts in progress and usually involves diplomatic action to bring hostile parties to a negotiated agreement. This can lead to either positive or negative peace.

- **Peacebuilding:** International Alert defines peacebuilding as “fundamentally about dealing with the reasons why people fight in the first place, while also supporting societies to manage their differences and conflicts without resorting to violence.” It is intended to promote positive peace.

This topic map tags concepts and examples by the gradients of **Relevant Types of Peace** and **Ways to Achieve Peace.**

TECHNOLOGIES ENABLING PEACE

PeaceTech relies on a variety of physical and digital and virtual tools and approaches to support peace. These efforts include creating platforms for dialogue and advocacy, generating images from the field for action, or building tools to carry out peace-oriented missions. There are many ways in which they may be used by individuals, groups, as well as governments to assist in reducing violence, building trust, and resolving conflict.

Among the many technologies that foster peaceful coexistence are:

- **3D Printing:** 3D printing offers low-cost alternatives to creating tools that can be used to promote peace. It enables earlier, faster, more tailored, and localized humanitarian action by manufacturing goods rapidly and locally where they are needed most. According to Joshua Pierce, a researcher at Michigan Tech who researches open-source and low-impact solutions to engineering problems, "low-cost open-source 3D printing has enormous potential to do real good for the world—particularly for the poor as it radically reduces the cost of high-value products like scientific tools and consumer goods."[4]

- **Artificial Intelligence/Machine Learning (AI/ML):** AI is experiencing a (partial) transition from rule-based systems to data-hungry machine learning, with key use cases in anomaly detection, predictive analytics, natural language processing, and voice and image recognition, among others. AI/ML can be used to predict and analyze conflict, as well as to improve mediation efforts. For instance, AI is being deployed alongside other imaging techniques, such as satellites and drones, to assess conflict situations and predict potential conflicts with minimal risk to human peacekeepers.[5] AI has also been used to monitor resource scarcity, which can drive conflicts and undermine stability in post-conflict environments. As well, natural language processing (NLP) algorithms can help to track and improve understanding of local political and social debates by wider audiences.[6]

- **Big Data:** Big data, or the capture, storage, and analysis of large troves and volumes of data, allows for existing and emerging technologies to operate faster and more reliably. In the peace field, large scale information about conflicts and their

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[4] Biggs, John. "An Interview With Dr. Joshua Pearce of Printers for Peace." *TechCrunch*, May 19, 2013. https://techcrunch.com/2013/05/19/an-interview-with-dr-joshua-pearce-of-printers-for-peace/?guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAA4B83EDO7kmAqcDji1TRiO1eFpqAGP4UzHByp4_DmdAFA_NAyJOLsybpTwhaAGEENpP32IzNkjA0Rx29ua87V84AJW2CDs4eZuHy5KQ2wwrWhY58kFcQFHTo7iFF29UOK173mXSRIn6JcpIFaRavMh-vETKmX3yIlE_EYuO_DC0&guccounter=2

[5] Masood, Daanish, and Martin Waehlisch. "AI & Global Governance: Robotics Will Not Only Wage Wars but also Future Peace." *United Nations University Centre for Policy Research*, April 23, 2019. https://cpr.unu.edu/publications/articles/robots-will-not-only-wage-future-wars-but-also-future-peace.html

[6] Ibid.

surrounding factors generates empirical evidence that supports prediction, response, and analysis projects when responding to conflicts.[7] However, issues around data collection, data privacy, and overall knowledge of working with data by peacekeepers and policymakers pose risks to big data practices in real-world situations.

- **Biometrics:** Governments and humanitarian agencies use biometrics to authenticate and identify individuals to ensure that (1) people are who they claim to be and (2) resources are equitably distributed to avoid fraud. The uptick in migration led to the integration of biometrics—iris scans, fingerprints, facial recognition technologies—to operationalize identity for national security. Proponents of biometrics claim that it is a more efficient, accurate, and dignified manner of delivering assistance and fulfilling peace missions.[8]

- **Digital Communications Infrastructure:** A mix of technologies are used to bridge the digital divide and expand the potential to engage in digital interactions and communications. These networks offer varying levels of security, capacity, latency, cost-efficiency, and ease of deployment—creating opportunities for mobile and online communications. Digital 2021 reports that 66.6% of people in the world are unique mobile phone users and 59.5% are internet users, with 53.6% being active users of social media.[9] Yet digital inequity can exacerbate social inclusion and create a 'digital vicious cycle.'[10] The inability to access digital technologies due to geographic, political, and/or income-based barriers further inhibits communication, socio-economic growth, and access to peacebuilding and peacemaking activities.

- **Distributed Ledger Technologies (DLTs):** DLTs are coming to maturity by ensuring enhanced traceability, trust in transactions, and shared information sets across all users to improve resource accountability and delivery. However, the practical applications built on these decentralized or distributed networks struggle to achieve scalable solutions outside of the financial industry. Key use cases for blockchain-based tools are in financial services, eGovernment services, and supply chains. Peace efforts have turned to DLTs to finance peacebuilding and conflict resolution efforts securely and transparently.

- **Drones:** Drones can be used to gather information about conflicts. The UN advocated an increase in the use of drones in humanitarian efforts, highlighting their ability to

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[7] Wählisch, Martin. "Big Data, New Technologies, and Sustainable Peace: Challenges and Opportunities for the UN." *Journal of Peacebuilding & Development*, 15, no. 1 (2019): 122-126. https://doi.org/10.1177/1542316619868984

[8] Jacobsen, Elida K. U. "Societal and Ethical Impact of Biometrics." *Peace Research Institute Oslo (PRIO) Policy Brief*, April 2019. https://www.prio.org/download/publicationfile/1841/Jacobsen,%20Elida%20K%20U%20-%20Societal%20and%20Ethical%20Impact%20of%20Biometrics,%20PRIO%20Policy%20Brief%204-2019.pdf

[9] *DataReportal*, n.d. https://datareportal.com

[10] Warren, Martyn. "The digital vicious cycle: Links between social disadvantage and digital exclusion in rural areas." *Telecommunications Policy* 31, no. 6-7 (2007): 374-388. https://doi.org/10.1016/j.telpol.2007.04.001

monitor and curb outbreaks of violence, and to gather information about the situation within conflict zones.[11] Coupled with sensors, biometrics, and AI, drones are being used to monitor borders and displacement.

- **Internet of Things (IoT):** Exceeding Moore's law, IoT is exploding, with a projected one trillion devices connected to the Internet in 2035. Combined with AI (either local/edge-based or cloud-based), IoT will gradually permeate and revolutionize the economy, society, and human beings. IoT is being used to enhance war efforts and make peacebuilding operations more effective. Specifically, real-time monitoring and mapping tools via sensors, cameras, and unmanned aerial vehicles (UAVs) allow peacekeepers to understand conflict situations with less harm to personal safety.[12]

- **Online Platforms:** Intermediate data exchanges help match demand and supply through multi-sided business models. These platforms often act as a private distributor and regulator that operates without much formal regulation. Most often, these services rely on corporate governance to decide their positions on algorithmic and data governance. Moreover, online and social media networks, led by peacebuilders or peace practitioners, are helping connect people around the world to spread literacy about conflict and engage in digital reconciliation activities.

- **Quantum Technologies:** Drawing on quantum physics and engineering, quantum technologies have been applied for computing, machine learning improvement, cryptography, radar and satellite technology, and communication networks. Quantum science can improve encryption to protect top secret data and enable trusted communication that protect peacekeepers and defense and security operations when gathering intelligence.[13]

- **Robotics:** Robotics is currently being used to spread messages of peace and monitor suspicious behaviors. One of the first instances of robots for peace was the use of surveillance drones in the Democratic Republic of Congo in 2006[14]. Similarly, in response to the Haiti Earthquake in 2010, the United Nations Satellite Centre (UNOSAT) used drones to complement satellite imagery and map internally displaced populations. In 2013, the first cargo drones were used to deliver medical supplies.[15]

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[11] "Drones and Satellites For Good—Keeping the Peace." *ReliefWeb*, August 4, 2015. https://reliefweb.int/report/democratic-republic-congo/drones-and-satellites-good-keeping-peace

[12] Dorn, Walter A. "Smart Peacekeeping: Toward Tech-Enabled UN Operations." *International Peace Institute*, July 2016. https://peaceoperationsreview.org/wp-content/uploads/2016/07/rel_docs_IPI-Rpt-Smart-PeacekeepingFinal.pdf

[13] Krelina, Michal. "Quantum technology for military applications." *EPJ Quantum Technology* 8, no. 24 (2021). doi.org/10.1140/epjqt/s40507-021-00113-y

[14] Van Wynsberghe, Aimee, and Tina Comes. "Drones in humanitarian contexts, robot ethics, and the human-robot interaction." *Ethics and Information Technology* 22 (2020): 43-53. https://doi.org/10.1007/s10676-019-09514-1

[15] Ibid.

- **Satellite Imagery:** Data from satellites can locate, measure, and draw attention to human rights, or ongoing conflicts. Satellite imagery can also be used to add missing infrastructure and help with disaster relief efforts.[16] For external humanitarian organizations, satellite data provides information about the local community accurately without requiring high-cost, time-consuming, and dangerous scoping of conflict zones or crisis areas.[17]

- **Virtual Reality:** Virtual reality and gamification are being used to familiarize people with the experiences of war. Writing for the Center for Empathy in International Affairs, Dr. Alexandra Ivanovitch argues that virtual reality is the new frontline of peace and "help[s] us transcend neurophysiological limitations inherent to our own point of view, and to adopt the perspective of another human being."[18] She further argues that virtual reality can help overcome bias and build empathy.

[16] Voigt, Stefan, Thomas Kemper, Torsten Riedlinger, Ralph Kiefl, Klaas Scholte, and Harald Mehl. "Satellite Image Analysis for Disaster and Crisis-Management Support." *IEEE Transactions on Geoscience and Remote Sensing* 45, no. 6 (2007): 1520-1528. doi: 10.1109/TGRS.2007.895830

[17] 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. "Remote Sensing for International Peace and Security: Its Role and Implications." *Remote Sensing* 13, no. 3 (2021): 439. https://doi.org/10.3390/rs13030439

[18] Ivanovitch, Alexandra. "Virtual Reality: The Frontier of Peacemaking." *Center for Empathy in International Affairs*, October 2017. https://www.centerforempathy.org/wp-content/uploads/2017/10/CEIA-Virtual-Reality-The-Frontier-of-Peacemaking.pdf

USE CASES OF TECHNOLOGIES ENABLING PEACE

Technology used for peace manifests across direct peacebuilding efforts and structural initiatives to build positive peace and promote coordinated use of resources and research on PeaceTech. To *contextualize* the **Technologies Enabling Peace**, below is a collection of some pertinent **examples of PeaceTech applications**, organized by technology categorization. Note that this list is non-exhaustive and incomplete.

Category	Use Cases of Peace Technologies	Relevant Types of Peace Tags	Achieving Peace Tags
3D Printing	***3D printers for peace contest:*** In 2013, Michigan Technological University's Open Sustainability Technology (MOST) Lab held a contest on 3D designs that could reduce conflict and encourage peace and safety. Inventions such as 3D immunization records, water purification cones, and Braille tablets were put forward to use 3D printers for peace.	*Positive Peace* *Humanitarian Peace* *Peace writ little*	*Peacebuilding, Peacemaking*
AI/ ML	***AI-powered conversational bots to enable peacebuilding in war zones:*** Stakeholders in Libya and Yemen used an AI-powered chat service to tell the international bodies how they feel about conflict issues.	*Positive Peace* *Peace writ little*	*Peacebuilding, Peacemaking*
AI/ ML	***Machine learning to detect and police violence in the online environment:*** In 2018, the United Nations High Commissioner for Refugees (UNCHR) and Global Pulse used machine learning to develop a tech robot with a human rights-based bias detecting xenophobia online against refugees to better understand what triggered dislike or hatred against people perceived as outsiders.	*Negative Peace* *Humanitarian Peace* *Peace writ large*	*Peacekeeping, Peacemaking*

AI/ ML	***Machine learning to survey infrastructure damage:*** The United Nations Development Programme (UNDP) developed a machine learning algorithm to help identify and classify war-damaged infrastructure. This model is replicable by the UNDP in other countries to help with post-conflict reconstruction. The model uses text mining to extract information from reports and categorize it by type of infrastructure. The UNDP Ukraine country office is also applying the model to Twitter data to determine the locations of damaged infrastructure and gauge the needs of vulnerable populations.	*Negative Peace* *Humanitarian Peace* *Peace writ large*	*Peacemaking*
AI/ ML	***Natural language processing for mediation:*** Using dialogue transcripts from peace negotiations in Yemen, Arana-Catania, van Lier, and Procter (2021) show how machine-learning tools can effectively support international mediators by managing knowledge and offering additional conflict analysis tools to assess complex information.	*Positive Peace* *Peace writ little*	*Peacebuilding, Peacemaking*
AI/ ML	***Use of content moderation to prioritize conciliatory messages:*** 'Peace bots' have been used to promote tolerance over hate speech and enable sentiment analysis. The Data-Pop Alliance used machine learning algorithms to analyze Facebook data and determine how residents of Botswana feel about the police and corruption.	*Positive Peace* *Humanitarian Peace* *Peace writ little*	*Peacebuilding, Peacekeeping*
Big Data	***Big data analytics for mediation:*** The UN reports that data analytics tools currently used in mediation contexts include Crimson Hexagon, Crowdtangle, DataminR, Europe Media Monitor, Factr, Google Analytics, Hootsuite, Storyful, Sysomos, Talkwalker and Twitterfall.	*Positive Peace* *Humanitarian Peace* *Peace writ large*	*Peacemaking*
Big Data	***Big data for activists:*** *Use of traditional and non-traditional data sources to enhance protests and demonstrations through online technologies. The South African "Reclaim the City" campaign used freedom of information requisitions to scrutinize whether the local Cape Town government was upholding its commitment to anti-apartheid and just housing schemes.*	*Positive Peace* *Humanitarian Peace* *Peace writ large*	*Peacekeeping*

Big Data	***Big data for conflict prevention:*** The Conflict Early Warning and Response Mechanism (CEWARN), was established in 2002 in East Africa to prevent and mitigate violent conflict. It claims to have helped significantly reduce violent conflict, particularly along the Kenya-Uganda as well as Ethiopia-Kenya-Somalia borders.	*Negative Peace* *Peace writ large*	*Peacebuilding, Peacekeeping*
Big Data	***Big data for humanitarian efforts:*** The United Nations Population Fund (UNPF) created a "common operational dataset" for humanitarian partners working in Ukraine in the first week of the war back in March 2022. The dashboard features updated population projections by gender, age, and region within Ukraine. UNPF data from Ukraine was fed into the Humanitarian Data Exchange (HDX) platform's Ukraine Data Explorer to provide open-source information about refugees, casualties, and funding needs for humanitarian efforts. This information has been used by other United Nations bodies, such as the IOM, to support vulnerable and internally displaced populations within Ukraine.	*Positive Peace* *Humanitarian Peace* *Peace writ large*	*Peacebuilding, Peacekeeping*
Big Data	***Big data for network analysis:*** Kate Keator, Manager of the Syria Conflict Mapping Team at The Carter Center, ran big data through an open source social network analysis software Gephi to model the complex relationships of armed groups in Syria's Aleppo Governorate.	*Positive Peace* *Peace writ large*	*Peacemaking*
Big Data	***Big data for researchers and activists:*** UN Women, along with CARE International, conducted a Rapid Gender Analysis to demonstrate the disproportionate impact the war on Ukraine has had on women and girls. This analysis seeks to highlight the gender dynamics in Ukraine prior to and post the war. The analysis uses secondary data to draw particular attention to the disparities, vulnerabilities, and risks that women and girls in Ukraine have experienced as a result of the intervention. For example, gender-based violence was rampant in Ukraine even prior to the Russian invasion, with 75% of women in the country stating that they had faced gender-based violence before the conflict. Gender-based violence has increased due to military conflict, with close to 82% of women stating that sexual harassment and assault in public spaces have increased.	*Positive Peace* *Peace writ large*	*Peacemaking*

Biometrics	***Tracking and identifying refugees:*** The World Food Programme (WFP) used a biometric registry in Yemen to improve food aid and improve cooperation for humanitarian purposes with the Houthi government.	*Negative Peace* *Humanitarian Peace* *Peace writ little*	*Peacebuilding, Peace enforcement, Peacemaking*
Digital Communications Infrastructure	***Use of social media for peace education:*** Naseem and Arshad-Ayaz (2020) explore the potential of social media as a space for teaching and bringing about sustainable peace.	*Positive Peace* *Peace writ large*	*Peacebuilding, Peacekeeping*
Digital Communications Infrastructure	***Digital connectivity for humanitarian organizations:*** NetHope is a non-profit that provides safe internet connectivity and digital solutions to connect organizations and people displaced by conflict.	*Negative Peace* *Humanitarian Peace*	*Peacebuilding,* *Peacemaking*
Distributed Ledger Technologies (DLTs)	***Blockchain for peace:*** Through its Venture Fund, the United Nations Children's Fund (UNICEF) is using Blockchain-based Software Solutions to Build Capacity and Empower Communities. Further, Stanford's Peace Innovation Lab examines the use of blockchain to contribute to peacebuilding.	*Positive Peace* *Peace writ large*	*Peacebuilding, Peace enforcement*
Drones	***Drones to improve community infrastructure:*** A project funded by the World Bank piloted a drone-based data capture program in Albania and found that the information gathered helped visualize new water, road, and urban planning initiatives and identify unauthorized or poor quality settlements and waste disposal sites.	*Positive Peace* *Peace writ little*	*Peacekeeping*
Internet of Things	***Sensors for monitoring conflict zones:*** Airborne, ground, and underground sensors help UN peacekeepers monitor areas for radiation, chemical or biological weapons, and landmines. In areas with ongoing conflict or adverse terrain early warnings of violence, monitoring the upholding of peace agreements, and sharing information help prevent and respond to issues, while sensor data sharing allows for more coordinated responses and can aid in trust building among affected parties.	*Negative Peace* *Humanitarian Peace* *Peace writ little*	*Peacebuilding, Peace enforcement, Peacemaking*

Online Platforms	***Big data for early warning and crisis prevention:*** Uwiano Platform for Peace was created from a partnership between local Kenyan stakeholders and the UNDP for Kenya's 2010 referendum on a new constitution. Uwiano provided a free text message service for Kenyans to report early signs of conflict such as "hate speech, incitement, and other forms of violence instigation."	*Positive Peace* *Humanitarian Peace* *Peace writ little*	*Peacekeeping*
Online Platforms	***Interactive data dashboards for visualization of conflict:*** Crisis Ready's interactive dashboard draws on "anonymized and aggregated human mobility data" gathered from Meta (formerly Facebook) to understand demographic and population density changes in Ukraine and surrounding countries over time compared to the average population 90-days before the target date to show data in a digestible form for more evidence-based action by policymakers and humanitarian organizations.	*Positive Peace* *Humanitarian Peace* *Peace writ large*	*Peacebuilding*
Online Platforms	***Platforms for global peacemaking:*** Tools such as Platform4Dialogue provide an online inclusive space to discuss conflicts and come together to innovate solutions to existing conflicts.	*Positive Peace* *Humanitarian Peace* *Peace writ large*	*Peacebuilding, Peacemaking*
Online Platforms	***Real-time tracking of conflict:*** Uses hourly data from the Twitter API to report on the incidence of important events in Ukraine, #DataforUkraine is a platform that provides timely information for private citizens, NGOs, INGOs and policymakers working on behalf of Ukraine.	*Negative Peace* *Humanitarian Peace* *Peace writ little*	*Peacebuilding, Peacemaking*
Online Platforms	***Web platforms oriented towards promoting peace-oriented innovation:*** The PeaceTech Exchange (PTX) program trains local community leaders with technology tools and solutions, acknowledging that there is a gap in skills and knowledge to leverage available resources in conflict areas.	*Positive Peace* *Peace writ large*	*Peacekeeping, Peacemaking*

Online Platforms	***Web platforms to crowdsource information on existing conflicts:*** Fact-checking organizations, such as Una Hikika, help reduce rumors and disinformation online. Similarly, crowdsourced information from local communities has been used to predict violence resurgence and increase the situational awareness of peacekeepers (so-called "participatory peacekeeping").	*Negative Peace* *Humanitarian Peace* *Peace writ little*	*Peacekeeping*
Online Platforms	***Wikipedia as an early warning system:*** A study found that Wikipedia country page views are a useful predictor of international interest in a country and potential conflict escalation. The study suggests that there is great potential for further research using Wikipedia data to refine measures and improve predictions. This data source provides unique insights that other commonly used data sources or models capture only to a lesser extent.	*Positive Peace*	*Peacekeeping*
Online Platforms	***The Twitter Crisis Misinformation Policy:*** Twitter put in place a policy to help reduce the spread of false information during moments of crisis. The policy requires verification from multiple credible sources before content from an account can be amplified or recommended across Twitter. In addition, warning notices will be added to highly visible Tweets and Tweets from high-profile accounts. Some examples of Tweets that may be covered by the policy include false coverage or event reporting, or information that mischaracterizes conditions on the ground as a conflict evolves. The goal of the policy is to help reduce potential harm and ensure that accurate information is being shared during periods of crisis.	*Positive Peace*	*Peacekeeping*
Quantum Technologies	***Quantum technology for secure communication****:* The NATO Science for Peace and Security program has been experimenting with quantum key distribution and post-quantum cryptography to protect sensitive information and securely share decryption keys to trusted parties.	*Negative Peace*	*Peacekeeping, Peacemaking*
Robotics	***Robots for cultural dialogue:*** A robot priest called Mindar uses machine learning "to tailor feedback to worshippers' specific spiritual and ethical problems."	*Positive Peace* *Humanitarian Peace* *Peace writ large*	*Peacekeeping, Peacemaking*

Robotics	***Robots to monitor public areas:*** Japan is using robots to monitor public spaces and put out warnings for people with suspicious behavior.	*Negative Peace Peace writ little*	*Peace enforcement, Peacekeeping*
Satellite Imagery	***GPS technology for migration*:** Syrian refugees are using Google Maps and location coordinate data to map their journeys. They share routes and information via Facebook groups to find safer ground.	*Negative Peace Peace writ little*	*Peacebuilding*
Satellite Imagery	***Landmine detection in active conflict zones:*** The HALO Trust demining organization has been using OSINT from social media and satellite images and GIS to find areas with "explosive remnants" and survey property damage so that aid organizations can move safely in Ukraine and help with the post-conflict reconstruction of cities.	*Negative Peace Humanitarian Peace* *Peace writ little*	*Peacebuilding, Peacekeeping*
Satellite Imagery	***Improving crisis response*:** The AAAS Geospatial Technologies and Human Rights Project gathers satellite image data to map the geographic impact of conflict.	*Positive Peace Humanitarian Peace* *Peace writ large*	*Peacebuilding, Peace enforcement, Peacemaking*
Satellite Imagery	***Satellite imagery for disaster/crisis recovery:*** *The Mapathon organized by Columbia University and Humanitarian OpenStreetMap in the aftermath of Hurricane Maria in Puerto Rico helped remap flood-affected areas to aid humanitarian efforts.*	*Negative Peace Humanitarian Peace* *Peace writ little*	*Peacebuilding, Peace enforcement*
Satellite Imagery	***Satellite imagery for human rights and to monitor population movements*:** The Australian Strategic Policy Institute and ABC News conducted a study that used satellite imagery to estimate the size and spread of Uyghur internment camps in western China.	*Negative Peace Humanitarian Peace* *Peace writ little*	*Peace enforcement, Peacebuilding, Peacemaking*
Satellite Imagery	***Satellite imagery for treaty enforcement*:** Satellite imagery has made numerous arms control pacts—from the Open Skies Treaty to the Comprehensive Test Ban Treaty—verifiable and therefore politically feasible.	*Negative Peace Peace writ large*	*Peace enforcement*
Satellite Imagery	***Starlink satellite service in Ukraine:*** Starlink, an online network service offered by SpaceX was provided to Ukrainian forces for secure communications. However, the back and forth on how long the service will be provided pro bono remains in the balance.	*Negative Peace Peace writ large*	*Peace enforcement, Peacekeeping*

Virtual Reality	***Games for peace:*** The online community Games for Peace uses video games to bridge the gap between young people in the Middle East and other conflict zones, using shared virtual experiences to build trust. UNESCO also organized an 8-month Digital Games for Peace Challenge that created four online games for kids and teenagers to teach social-emotional learning, intercultural dialogue, and work toward the prevention of violence and extremism.	*Positive Peace* *Peace writ large*	*Peacebuilding, Peacekeeping*
Virtual Reality	***Virtual reality for conflict:*** The Enemy—an immersive virtual reality experience that combines artificial intelligence and neuroscience research on empathy—brings users face to face with ideas of enemy and empathy, deepening their knowledge of long-standing conflicts.	*Negative Peace* *Peace writ large*	*Peacebuilding, Peacekeeping*

SECTION II

APPLICATIONS OF PEACE TECHNOLOGIES

As demonstrated previously, the tools used in PeaceTech vary from technologies co-opted for peace efforts to those specifically made for peace promotion. Exploring both to *operationalize* the **Technologies Enabling Peace**, below is a collection of some methods by which PeaceTech tools have been used, organized into six categories—prediction, narratives, infrastructure damage response, monitoring human rights violations and abuses, migration flows, and humanitarian response. Note that this list is non-exhaustive and incomplete.

PREDICTION

Pre-conflict data is being used to predict the risk and propensity of future violence.

- **Big data and facial recognition to identify potential terrorists:** Indeed, big data can help peacebuilders understand changes in human well-being, which, in turn, helps to formulate a timely policy response.[19] Increasingly, peacekeepers have turned to ML for predictive peacekeeping, predictive policing, and prevention/anticipation of violence or social unrest. In a study conducted in Indonesia, Global Pulse (2014) mined tweets to measure Indonesians' perceptions of food prices in order to anticipate social unrest in relation to spikes in the cost of living.

- **Early warning and forecasting violence or conflict:** Early warning and response systems are a powerful tool to provide reliable and readily available warnings about violent attacks, airstrikes, and other near and long-term security threats facing vulnerable civilian populations.[20] For instance, Crisis Mappers operates a global network of volunteers who use open-source intelligence (OSINT) to identify potential threats and crises.[21] They provide effective early warnings and rapid responses to complex humanitarian emergencies by using a variety of mobile and web applications, maps and crowdsourced event data, satellite imagery, visualizations, simulations, and computational models. Moreover, research by Voukelatou et al. (2022) affirmed that

[19] Duursma, Allard. "Mapping Data-Driven Tools and Systems for Early Warning, Situational Awareness, and Early Action." *Pax for Peace*, January 2021. https://paxforpeace.nl/media/download/2104%20D4P%20report%20AD.pdf

[20] "Defining a Brave New Field: Technology and the Protection of Civilians in Conflict." *International Peace Institute*, 2019. https://sipa.columbia.edu/file/9823/download?token=_c3J_LaR

[21] *Crisis Mappers*, n.d. https://crisismapping.ning.com

machine learning models are a powerful tool for predicting the Global Peace Index (GPI).[22] However, more information is needed about the causes of conflict and war to improve early-warning systems. This is a difficult task because conflict and war dynamics are multi-dimensional, and the data collected today is often too narrow, sparse, and disparate.

NARRATIVES

Data plays a critical role in both constructing and countering misinformation and disinformation. PeaceTech is being used to track narratives about the conflict, including identifying and mapping misinformation and disinformation as well as understanding how various audiences receive and engage with information about the conflict.

- **Conflict narratives:** The Russia-Ukraine war has seen an unprecedented use of online platforms and data to spread information (as well as misinformation and disinformation) about the conflict has been deployed by actors on both sides.[23] Data is also being used to track narratives about the conflict. This includes identifying and mapping misinformation and disinformation as well as understanding how various audiences receive and engage with information about the conflict, such as Newsguard's tracker that monitors websites that share disinformation on the Ukraine-Russia conflict and highlights the most popular false narratives circulating online.[24] Moreover, Researchers from the University of Warsaw looked at sentiment analysis and narrative trends pertaining to the war in Ukraine from January 2022 to March 2022, trying to determine changes in emotions before and after the war in Ukraine.[25] Their research showed that sentiment analysis "makes it possible to detect the change dynamics that are difficult for a human being to capture (a person analyzing source materials)."

- **Public participation in war:** Civilians are increasingly playing an active role in conflicts. Slim (2022) notes that "millions of people in war are using their social media accounts to visualize, record and describe the wars in which they find themselves as

[22] Voukelatou, Vasiliki, Ioanna Miliou, Fosca Giannotti, and Luca Pappalardo. "Understanding peace through the world news." *EPJ Data Science* 11, no. 1 (2022): 2. 10.1140/epjds/s13688-022-00315-z

[23] Wakefield, Jane. "Ukraine invasion: How the war is being waged online." *BBC News*, February 28, 2022. https://www.bbc.com/news/technology-60559011

[24] Roache, Madeline, Sophia Tewa, Alex Cadier, Chine Labbe, Virginia Padovese, Roberta Schmid, Edward O'Reilly, Marie Richter, Karin König, McKenzie Sadeghi, Chiara Vercellone, Zack Fishman, Natalie Adams, Valerie Pavilonis, Shayeza Walid, Kelsey Griffin, Coalter Palmer, Andie Slomka, Louise Vallée and Akshata Kapoor. "Russia-Ukraine Disinformation Tracking Center." *NewsGuard*, September 28, 2022. https://www.newsguardtech.com/special-reports/russian-disinformation-tracking-center

[25] Cetera, Wiesław, Aleksander Żołnierski, Dariusz Jaruga, Piotr Celinski, Jan Grzegorek. "Sentiment analysis for identifying the political inflection point in Putin's war." *Advance*, 2022. https://doi.org/10.31124/advance.20098097.v1

combatants, civilians, humanitarians, peacebuilders or activists for one side or the other. Millions of others watch wars from afar and join their information battles by taking sides as they like and share the messages they find."[26] Examples include seven-year-old Bana Al-Abed, whose documentation of the fall of Aleppo in 2016 drew thousands of followers.[27] As well, real-time footage of the Russia-Ukraine war on social media platforms demonstrates public participation in the conflict.[28]

- **Virtual humanitarianism:** Humanitarians are increasingly operating as virtual agents in digital spaces to connect with people's virtual lives, alongside their physical lives. As noted by Slim (2022), "[a] great part of humanitarian time is now spent monitoring and engaging with warfare in cyberspace, protecting humanitarian data, and countering strategies of misinformation, disinformation and hate speech in virtual space.

INFRASTRUCTURE DAMAGE RESPONSE

Data can be used to track and respond to infrastructure damage, as well as to associated human rights violations and migration flows.

- **Peacekeeper and beneficiary safety and security (e.g. IED or landmine detection):** Counter-IED equipment is used for standoff detection of explosives and explosive precursor components and defeating Improvised Explosive Devices (IEDs) devices. Robots, drones, vehicles, and tech-imbued armors are being used to spot and disarm IEDs with less direct harm to peacekeepers and civilians. UAVs, for example, are a popular option for quick geospatial data gathering and are relatively cheap and easy to operate.[29]

- **Technology for basic provisioning in conflict settings (e.g. communications, water, electricity):** Digital technologies are changing humanitarian aid assessment and distribution[30] and providing basic needs in humanitarian settings such as logistics, power, or connectivity.[31] For example, the UNDP's machine learning algorithm helps

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[26] "Warfare today and tomorrow." *Oxford University*, n.d. https://www.elac.ox.ac.uk/programmes-projects/solferino-21/warfare-today-and-tomorrow/#ngw

[27] Molloy, David. "Meet the seven-year-old girl tweeting from Aleppo." *BBC*, October 2, 2016. https://www.bbc.com/news/world-middle-east-37535343

[28] Brown, Sara. "In Russia-Ukraine war, social media stokes ingenuity, disinformation." *MIT Management*, April 6, 2022. https://mitsloan.mit.edu/ideas-made-to-matter/russia-ukraine-war-social-media-stokes-ingenuity-disinformation

[29] Vota, Wayan. "7 Technologies to Mitigate Humanitarian Crisis and Increase Community Resilience." *Technology Salon*, March 8, 2018. https://technologysalon.org/7-technologies-humanitarian-crisis

[30] Slim, Hugo. "A new Solferino moment for humans." *Humanitarian Law & Policy*, Feburary 10, 2022. https://blogs.icrc.org/law-and-policy/2022/02/10/new-solferino-moment-humanitarians/

[31] Vota, Wayan. "7 Technologies to Mitigate Humanitarian Crisis and Increase Community Resilience." *Technology Salon*, March 8, 2018. https://technologysalon.org/7-technologies-humanitarian-crisis

identify and classify war-damaged infrastructure.[32] This model is replicable by the UNDP in other countries to help with post-conflict reconstruction. The model uses text mining to extract information from reports and categorize it by type of infrastructure. The UNDP Ukraine country office is also applying the model to Twitter data to determine the locations of damaged infrastructure and gauge the needs of vulnerable populations. Further in the context of the Russia-Ukraine war, Premise launched an Open Build Ukraine project that collects and analyzes data. Their findings suggest that access to food and fuel is decreasing across Ukraine and that refugees are settling in host communities without access to proper support.[33]

- **Tracking and fleet management for aid and resource delivery:** Logistics play a central role in humanitarian and post-conflict settings. An INSEAD report[34] estimates that "transportation is the second largest overhead cost to humanitarian organizations after personnel."[35] As a result of fleet management, fleet sizes and procurement costs have decreased while improving service delivery speeds.

MONITORING HUMAN RIGHTS VIOLATIONS AND ABUSES

Data is used to identify and report human rights abuses and to help construct a legal basis for justice and accountability efforts, as well as to target humanitarian assistance.

- **Bearing witness to/ raising awareness of atrocities:** Researchers are increasingly using AI, ML, and satellite imagery to document war crimes and atrocities. For example, a project by Swansea University is scouring through the tens of thousands of hours of footage that document violations in Yemen.[36] In addition, satellite companies are taking part in the hunt to bring Russian troops to justice, by putting their technology to use to find imagery of atrocities from the conflict in Ukraine.[37]

- **Data aggregation/ visualization to report human rights abuses:** Syria Tracker is an example of how technology can be used to monitor and visualize humanitarian

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[32] Shamoug, Aladdin. "In Ukraine, machine-learning algorithms and big data scans used to identify war-damaged infrastructure." *UNDP*, July 5, 2022. https://www.undp.org/blog/ukraine-machine-learning-algorithms-and-big-data-scans-used-identify-war-damaged-infrastructure

[33] Wilson, Alexandra. "Introducing Premise's Open Build Ukraine Project." *Premise*, March 17, 2022. https://www.premise.com/blog/introducing-premises-open-build-ukraine-project/

[34] Pedraza Martinez, Alfonso, Orla Stapleton, and Luk N. Van Wassenhove. "Field Vehicle Fleet Management in Humanitarian Operations: A Case-based Approach." *Journal of Operations Management* 29, no. 5 (2011): 404-421. https://doi.org/10.1016/j.jom.2010.11.013

[35] Ibid.

[36] Hao, Karen. "Human rights activists want to use AI to help prove war crimes in court." *MIT Technology Review*, June 25, 2020. https://www.technologyreview.com/2020/06/25/1004466/ai-could-help-human-rights-activists-prove-war-crimes/

[37] Bender, Bryan. "Satellite companies join the hunt for Russian war crimes." *Politico*, April 6, 2022. https://www.politico.com/news/2022/04/06/satellite-russian-war-crimes-00023386

abuses.[38] The project has mapped and monitored the conflict in Syria since 2011 to help journalists, human rights organizations, and the UN to investigate the humanitarian situation. Conflict Observatory is a new effort to document and publicly share evidence of war crimes and atrocities committed by Russia in Ukraine.[39] The goal is to help bring perpetrators to justice and to deter future war crimes.

- **Post-election violence monitoring and mapping:** Online information about election-related violence can be gathered and disseminated more quickly and effectively. Technology now allows us to better monitor election violence by tracking and analyzing structural tensions, social divides, and friction points.[40] However, it can be difficult to verify the accuracy of the information spread via social media. It can also be challenging to track all of the different conversations taking place on social media in the course of monitoring the post-election violence.

MIGRATION FLOWS

PeaceTech can help monitor migration flows from conflict zones and target humanitarian assistance.

- **Network analysis for intelligence and conflict resolution:** Researchers have stated that computational approaches have the potential to advance conflict research by identifying "spatio-temporal dynamics and mechanisms behind conflicts through simulation models" through the availability of new "fine-grained datasets of conflict events."[41] For instance. the UNHCR's map to visualize migrations happening across Europe as a result of the war shows where refugees have crossed borders. The data portal aims to monitor the Ukraine refugee situation and reflect recent movements of refugees in order to better aid humanitarian actions.[42] As of 5 July 2022, over 8.5 million border crossing instances have been recorded from Ukraine since the start of the war.

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[38] *Syria Tracker*, n.d. https://syriatracker.crowdmap.com.

[39] *Conflict Observatory*, n.d. https://conflictobservatory.org

[40] Mutahi, Patrick, and Brian Kimari. "The Impact of Social Media and Digital Technology on Electoral Violence in Kenya." *IDS Working Paper*, no. 493 (2017). https://opendocs.ids.ac.uk/opendocs/bitstream/handle/20.500.12413/13159/Wp493_Online.pdf?sequence=287

[41] "Analyzing Shifts in Territorial Control within Syria Offers Glimpse of Future Challenges." *The Carter Center*, May 13, 2020. https://www.cartercenter.org/news/features/p/conflict_resolution/syria-mapping-shifts-in-territorial-control.html

[42] "Operational Data Portal." *UNHCR—Ukraine Refugee Situation*. https://data.unhcr.org/en/situations/ukraine

HUMANITARIAN RESPONSE

In addition to the above, data and technology support a wide variety of humanitarian purposes, including ensuring basic and medical supplies and providing post-conflict recovery tools.

- **Data for coordinated humanitarian response:** The EU Agency for the Space Programme (EUSPA) created a data sharing platform that provides access to the Galileo and Copernicus databases to help nonprofits to provide humanitarian support and connect these groups to app developers.[43]

- **Humanitarian financing:** Aid financing through donations, philanthropy, and government and private grants is experiencing a shift towards digital cash transfers. In 2004, only 1% of humanitarian aid was given as cash. In 2019, the CALP Network reported that cash transfers have risen to 18% and continue to rise.[44] Digital cash can empower individuals while facilitating more agile, transparent, traceable, and cost-effective humanitarian action.[45]

- **Intelligence, reconnaissance, and surveillance (ISR):** OSINT is increasingly being used for long-term peacebuilding purposes. Dupont (2003) remarks that OSINT "is as least as important as classified intelligence" because of the rapid and expanding amount of OSINT data generated and its cost-effective ability to provide informed analysis.[46] OSINT is also easier to access because it is not hidden behind paywalls or security restrictions, allowing security organizations to leverage this public information for data-driven peacebuilding and security promotion.[47]

- **Participatory and inclusive mediation:** At present, the digital technologies and related tools and techniques most used in mediation include social media, geographic information systems, and data analytics.[48] A UN report states that "[t]he opportunities and efficiencies that digital technologies bring to the field of mediation are significant," citing advancements in conflict analysis, meditation, and public communications

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[43] "#EUSpace4Ukraine." *EUSPA*, n.d. https://www.euspa.europa.eu/euspace4ukraine-humanitarian-help-1

[44] "Humanitarian aid past and present." *Oxford University*, n.d. https://www.elac.ox.ac.uk/programmes-projects/solferino-21/humanitarian-aid-past-and-present

[45] Arendt-Cassetta, Leonie. "From Digital Promise to Frontline Practice: New and Emerging Technologies in Humanitarian Action." United Nations Office for the Coordination for Humanitarian Affairs (OCHA), April 2021. https://reliefweb.int/sites/reliefweb.int/files/resources/From%20digital%20promise%20to%20frontline%20practice%20-%20new%20and%20emerging%20technologies%20in%20humanitarian%20action.pdf

[46] Dupont, Alan. "Intelligence for the Twenty-First Century." *Intelligence and National Security* 18, no. 4 (2003): 15-39. https://doi.org/10.1080/02684520310001688862

[47] Gruters, Peter C., and Katherine T. Gruters. "Publicly Available Information: Modernizing Defense Open Source Intelligence." *Special Operations Journal* 4, no. 1 (2018): 97-102. https://doi.org/10.1080/23296151.2018.1457895

[48] "Digital Technologies and Mediation in Armed Conflict," March 2019. peacemaker.un.org/digitaltoolkit

strategies."[49]

- **Using digital technology to protect civilians in conflict zones:** An IPI report notes that new technologies can "enhance security, improve the delivery of humanitarian assistance, and bolster accountability for human rights violations."[50] These technologies include remote sensors, crisis maps, satellite imagery, mesh networks, UAVs, blockchain technology, cryptocurrencies, and controlled capture devices.

[49] Ibid.

[50] "Defining a Brave New Field: Technology and the Protection of Civilians in Conflict." *International Peace Institute*, 2019. https://sipa.columbia.edu/file/9823/download?token=_c3J_LaR

SECTION III

CHALLENGES AND CONSIDERATIONS

Peace technology has a dual effect. As has been shown above, technology can have many beneficial consequences, helping enhance short-term peacebuilding efforts as well as long-term sustainable goals contributing to lasting, positive peace. However, it also comes with certain constraints, challenges, and gaps. As noted by Slim (2022), civilians living increasingly virtual lives alongside their physical lives can expect to find warfare played out through phones, laptops, and the wider IoT technologies.[51] This may result in them being targeted by surveillance, misinformation, disinformation, or hate speech, and as their digital access to information, finance and public services become the object of attack and defense in cyber warfare.

This section looks at key challenges facing peace tech today and in the future.

ASYMMETRIES

- **Data Asymmetries:** According to IPI, "[t]he same lack of resources, capacities, and opportunities that prevents broader Internet access creates similar inequalities in the quality of data in developed versus developing countries."[52] Issues in collecting and analyzing data in war-prone countries create inaccurate baselines.

- **Data Governance:** Compared to earlier days of cyberspace, data governance has evolved into a nuanced domain of social science and engineering. Today, there is a need to differentiate between various models allowing for free-flowing data, managed data spaces, pooling of data for social purposes, or the protection of data confidentiality in the academic and policy debate.

- **Digital Inequalities:** Digital connectivity and inclusion issues remain prevalent in today's world, making the use of technology for short or long-term peace inaccessible to some people. According to Statista, as of January 2021, there were 4.66 billion active internet users worldwide—59.5 percent of the global population.[53] Of this total, 92.6 percent (4.32 billion) accessed the internet via mobile devices. Researchers have noted that digital inequalities increased during the COVID-19 pandemic, impacting

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[51] Slim, Hugo. "A new Solferino moment for humans." *Humanitarian Law & Policy*, Feburary 10, 2022. https://blogs.icrc.org/law-and-policy/2022/02/10/new-solferino-moment-humanitarians/

[52] "The Impact of New Technologies on Peace, Security, and Development." Independent Commission on Multilateralism, April 2016. https://www.icm2016.org/IMG/pdf/new_tech_paper.pdf

[53] "Number of internet and social media users worldwide as of July 2022." Statista, 2022. https://www.statista.com/statistics/617136/digital-population-worldwide/

social interactions and access to information.[54]

- **Echo Chambers and Epistemic Bubbles:** An echo chamber is a structure from which other relevant voices have been actively excluded and discredited. An epistemic bubble is a social structure in which other relevant voices have been left out, perhaps accidentally but most often deliberately. Md. Sayeed Al-Zaman, a lecturer at Jahangirnagar University in Bangladesh, discusses how the country's increasing number of "netizens" are being manipulated by online disinformation and inciting violence along religious lines.[55] Social media helps quickly spread Anti-Hindu and Buddhist rhetoric, inflaming religious divisions between these groups and Bangladesh's Muslim majority, impeding possibilities for "peaceful coexistence.

- **Polarization:** A recently published publication[56] through the Center for Business and Human Rights[57] at New York University's Stern School of Business sheds light on the relationship between technology platforms and extreme polarization that can lead to the erosion of democratic values and partisan violence.

HACKING

- **Infrastructure:** Increasing reliance on technologies has led to the risk of infrastructure sabotage, particularly critical infrastructure sabotage. This can be defined as "an unauthorized and overt act intended to cause a substantial and widespread interruption or impairment of a fundamental service rendered by the critical infrastructure."[58]

- **Malware:** Malware created by state-sponsored groups, terrorist organizations, and private companies sent via online communications to hack activist groups and target dissenters. In 2015, Syrian opposition members were targeted by Group5 to blend opposition messaging with malware that can convincingly be mistaken as supporting content.[59]

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[54] Beaunoyer, Elisabeth, Sophie Dupéré, and Matthieu J. Guitton. "COVID-19 and digital inequalities: Reciprocal impacts and mitigation strategies." *Computers in Human Behavior* 111 (October 2020): 106424. https://doi.org/10.1016/j.chb.2020.106424

[55] Al-Zaman, Md. Sayeed. "Digital Disinformation and Communication in Bangladesh." *China Media Research* 15, no. 2 (2019): 1-9. https://osf.io/preprints/socarxA new Solferino moment for humanitarians - Humanitarian Law & Policy Blogiv/8s6jd/

[56] Barrett, Paul M., Justin Hendrix, and J. Grant Sims. "Fueling the Fire: How Social Media Intensifies U.S. Political Polarization—And What Can Be Done About It." *New York University Stern Center for Business and Human Rights*, September 2021. https://bhr.stern.nyu.edu/polarization-report-page

[57] *New York University Stern Center for Business and Human Rights*,n.d. https://bhr.stern.nyu.edu

[58] Iowa Code 2022, Section 716.11 (6, 0). https://www.legis.iowa.gov/docs/code/716.11.pdf

[59] Scott-Railton, John, Bahr Abdul Razzak, Adam Hulcoop, Matt Brooks, and Katie Kleemola. "Group5: Syria and the Iranian Connection." *The Citizen Lab*, August 2, 2016. https://citizenlab.ca/2016/08/group5-syria/

INFORMATION DISORDERS

- **Dis/Mis-information:** This field has gained increasing importance in recent years with the use of the internet. Dis/mis-information has long-lasting effects on democratic governance, health, and social unity, among other things. The International Committee of the Red Cross (ICRC) states that "the use of digital technologies that amplify the spread of harmful information—such as misinformation, disinformation and hate speech online—is seen as a growing risk and challenge in places affected by war and violence.[60] While these phenomena are not new, technologies have a considerable impact on the scale and speed at which harmful information reaches multiple target audiences online, and the effect it has on them."
    - For example, in India, WhatsApp messages work in tandem with ideas, tropes, messages, and stereotypes already in the public domain, providing "verification" of fake news. These messages target historically discriminated groups (Dalits, Muslims, Christians, and Adivasis) by spreading allegations of bovine-related issues, child-snatching, and organ harvesting, culminating in violence against these groups with fatal consequences.[61]

- **Extremism:** Extremism is exacerbated by the use of social media and online platforms. Violence attributed to online hate speech has increased worldwide. Societies confronting the trend must deal with questions of free speech and censorship on widely used tech platforms. Online sites also breed terrorist/radicalization practices. The Islamic State has used the internet for recruitment purposes. Among the individuals profiled in PIRUS,[62] a detailed database of people in the United States who have been radicalized, social media played a role in the process for 27% of them between 2005 and 2010.[63] That number increased to 73% between 2011 and 2016. Similarly, the UN has warned that right-wing terror groups are using the COVID-19 health crisis to radicalize and recruit online—it noted a 750% increase in anti-Semitic tweets as the outbreak began, amid escalating hate crimes against people of Asian

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[60] "Harmful Information – Misinformation, disinformation and hate speech in armed conflict and other situations of violence: ICRC initial findings and perspectives on adapting protection approaches." *International Committee for the Red Cross,* n.d. https://shop.icrc.org/harmful-information-misinformation-disinformation-and-hate-speech-in-armed-conflict-and-other-situations-of-violence-icrc-initial-findings-and-perspectives-on-adapting-protection-approaches-pdf-en.html

[61] Banaji, Shakuntala, and Ram Bhat. "WhatsApp Vigilantes: An exploration of citizen reception and circulation of WhatsApp misinformation linked to mob violence in India." *London School of Economics*, n.d. http://eprints.lse.ac.uk/104316/1/Banaji_whatsapp_vigilantes_exploration_of_citizen_reception_published.pdf

[62] *Profiles of Individual Radicalization in the United States (PIRUS*), n.d. https://www.start.umd.edu/pirus-frequently-asked-questions

[63] "The Use of Social Media by United States Extremists." *PIRUS Research Brief*, n.d. https://www.start.umd.edu/pubs/START_PIRUS_UseOfSocialMediaByUSExtremists_ResearchBrief_July2018.pdf

descent.[64]

- **Homophily (the closed network effect):** The homophily principle states that people's personal networks are homogeneous with regard to many socio-demographic, behavioral, and intrapersonal characteristics.[65] Therefore homophily limits people's social worlds in a way that has powerful implications for the information they receive, the attitudes they form, and the interactions they experience. The consequence is that conversations enabled through homophilic systems are more and more polarized towards one unique vision, that is, the vision of the people forming the network.

REPRESSION

- **Censorship:** Along with surveillance, censorship remains an issue exacerbated by the use of technology in authoritarian states. Freedom House found that in 2021, global internet freedom declined for the 11th consecutive year and that free expression online is under unprecedented strain.[66]

- **Digital Transnational Repression:** Spyware, malware, and online harassment by governments and state-sponsored actors occurs across borders towards refugees, dissidents, and those living in exile. A Freedom House report notes [67]that digital tools "make it easier than ever for authoritarian governments to control, silence, and punish dissent across borders." The murder of Jamal Khashoggi is a well-documented example of spyware being used to surveil and locate political dissidents.

- **Surveillance:** Monitoring and surveillance technologies can be used by governments to identify and target dissenters or political opportunities. Multimedia and geo-tagged posts on social media sites have been gathered by police/oppressors to identify and target activists. The 2011 uprising against the Syrian government was met with severe censorship, widespread monitoring, and malware attacks to identify activists and

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[64] Counter-Terrorism Committee Executive Directorate. "Member States concerned by the growing and increasingly transnational threat of extreme right-wing terrorism." *United Nations Security Council*, April 2020. https://www.un.org/securitycouncil/ctc/sites/www.un.org.securitycouncil.ctc/files/files/documents/2021/Jan/cted_trends_alert_extreme_right-wing_terrorism_july.pdf

[65] Ayala, Anahi. "The Dichotomy of Technology in Conflict Beauty and the Beast." *The Global Interagency Security Forum*, May 2018. https://gisf.ngo/wp-content/uploads/2020/02/2248-EISF-2014-The-Dichotomy-of-Technology-in-Conflict.pdf

[66] Funk, Allie, and Adrian Shahbaz. "The Global Drive to Control Big Tech." *Freedom House*, 2021. https://freedomhouse.org/report/freedom-net/2021/global-drive-control-big-tech

[67] Michaelsen, Marcus. "The Digital Transnational Repression Toolkit, and Its Silencing Effects." *Freedom House*, 2020. https://freedomhouse.org/report/special-report/2020/digital-transnational-repression-toolkit-and-its-silencing-effects

arrest them.[68] As well, facial recognition datasets, such as those offered by Clearview AI, have been used by law enforcement to arrest #BlackLivesMatter protests in violation of Fourth Amendment rights.[69]

WEAPONIZATION

- **3D Printing to Create Weapons:** As outlined in a recent RAND Corporation report, and as reflected in ongoing domestic debates, widespread 3D printing could cause a spike in the proliferation of weapons, fundamentally increasing the acceleration and potential for global conflict, extremism, and crime.[70] Additionally, as other nations develop enhanced 3D printing capabilities, they can deploy this expertise to locally produce scarce and costly military equipment, enabling them to sidestep sanctions on technology and weapon transfers.

- **Augmented Humans**: Slim (2022) notes that increasingly, bodily enhancements in individual combatants will be prevalent in future combat.[71] He claims that combatants will be fused with digital systems via gadgets, augmented reality headsets, and digital implants to become multi-domain combatants. In addition, biotech enhancements will deliver new drugs to increase stamina, reduce fear and heighten perception, and provide exoskeletons for greater speed and agility of fighters.[72]

- **Data as a Weapon:** The sharing or seizure of data about vulnerable populations in and from conflict zones can fuel discrimination and ethno-religious tensions. This was demonstrated by the creation of smart cards for the Rohingya refugees in Bangladesh, whose biometrics were entered into the United Nations High Commissioner for Refugees' (UNHCR) Biometric Identity Management System (BIMS), a data to collect "body-based" identifiers of refugees.[73] The Rohingya's data in BIMS were later shared with the Myanmar government during the repatriation process and allowed Myanmar

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[68] Moore-Gilbert, Kylie, and Zainab Abdul-Nabi. "Authoritarian downgrading, (self)censorship and new media activism after the Arab Spring." *New Media & Society* 23, no. 5 (2021): 875–893. https://doi.org/10.1177/1461444818821367

[69] Vincent, James. "NYPD used facial recognition to track down Black Lives Matter activist." *The Verge*, August 18, 2020. https://www.theverge.com/2020/8/18/21373316/nypd-facial-recognition-black-lives-matter-activist-derrick-ingram

[70] Johnston, Trevor, Troy D. Smith, and J. Luke Irwin. "Additive Manufacturing in 2040: Powerful Enabler, Disruptive Threat." Santa Monica, CA: RAND Corporation, 2018. https://www.rand.org/pubs/perspectives/PE283.html.

[71] Ibid.

[72] "Humanitarian aid past and present." *Oxford University*, n.d. https://www.elac.ox.ac.uk/programmes-projects/solferino-21/humanitarian-aid-past-and-present

[73] "Biometric Identity Management System." *United Nations High Commissioner for Refugees (UNHCR)*, n.d. https://www.unhcr.org/protection/basic/550c304c9/biometric-identity-management-system.html

to continue to discriminate against the ethnic minority.[74] Similarly, during the fall of Afghanistan, the Taliban seized American military biometric devices that contained identification information of Afghan allies and military officials.[75] More recently, open-source intelligence data posted on OpenStreetMap and Google Maps has been met with requests for information removal by Ukrainians who worry that Russian forces are using these updates for attack strategies.[76]

- **Non-Productive Use of Technology:** A United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) report notes that "[i]identifying the best solution according to need may require de- linking "innovation" from "technology."[77] The most innovative approach may not employ cutting-edge technology, instead adapting an existing solution to a new problem or addressing an existing problem through a new process."[78]

- **Technology Biases:** As digital technologies become more sophisticated, so does technology-facilitated gender-based violence (TFGBV). This type of violence can take many forms, from the spread of extreme narratives against certain races or groups of women to the release of personal information and private images without consent to online stalking and death threats.

- **Weaponization of AI/ Machine Learning:** According to Forbes,[79] AI weaponization is being used for several purposes, from "navigating and utilizing unmanned naval,[80] aerial, and terrain vehicles, producing collateral-damage estimations, deploying "fire-and-forget" missile systems,[81] and using stationary systems to automate everything from personnel systems and equipment maintenance to the deployment of

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[74] Rioseco, Hanna. "The Promise and Peril of Biometrics in Delivering Humanitarian Aid." *International Human Rights Internship Program Working Paper Series* 9, no. 1 (2020). https://www.mcgill.ca/humanrights/files/humanrights/rioseco_ihrip_v9_2021.pdf

[75] Klippenstein, Ken, and Sara Sirota. "The Taliban Have Seized U.S. Military Biometrics Devices." *The Intercept*, August 18, 2021. https://theintercept.com/2021/08/17/afghanistan-taliban-military-biometrics

[76] Oxendine, Chris. "Ukraine: Open-Source Data Aided Response and Documents Damages and Atrocities." *ESRi Blog,* June 14, 2022. https://www.esri.com/about/newsroom/blog/ukraine-open-source-intelligence

[77] Arendt-Cassetta, Leonie. "From Digital Promise to Frontline Practice: New and Emerging Technologies in Humanitarian Action." *United Nations Office for the Coordination for Humanitarian Affairs (OCHA)*, April 2021. https://reliefweb.int/sites/reliefweb.int/files/resources/From%20digital%20promise%20to%20frontline%20practice%20-%20new%20and%20emerging%20technologies%20in%20humanitarian%20action.pdf

[78] Ibid.

[79] Pandya, Jayshree. "The Weaponization of Artificial Intelligence." *Forbes*, January 14, 2019. https://www.forbes.com/sites/cognitiveworld/2019/01/14/the-weaponization-of-artificial-intelligence/?sh=246a89536867

[80] Turnbull, Grant. "Autonomous & intelligent: the era of unmanned naval warfare." *Naval Technology*, February 10, 2014. https://www.naval-technology.com/features/featureautonomous-intelligent-the-era-of-unmanned-naval-warfare-4175458/

[81] Rogoway, Tyler. "Is the European Meteor Air-To-Air Missile Really the Best in the World?" *The Drive*, July 2, 2020. http://www.thedrive.com/the-war-zone/4678/is-the-european-meteor-air-to-air-missile-really-the-best-in-the-world

surveillance drones,[82] and robots."[83] In *New Fire* (2022), authors Ben Buchanan and Andrew Imbrie write that AI is influencing violence in three ways: through "data, algorithms, and computing power."[84] These aspects "fuel viral disinformation campaigns, new hacking tools, and military weapons that once seemed like science fiction."[85]

INTERNATIONAL LAW

The Law of Armed Conflict (LOAC), which governs "the conduct of hostilities" is mainly based on the Hague Conventions of 1899 and 1907, as well as the 1945 United Nations Charter.[86] While frameworks have been expanded and updated to adapt to modern warfare technologies and practices, the slow pace of these changes fails to regulate emerging digital tools and novel uses of technology in war, creating legal and governance gray zones.

- **Cyberspace and platform governance:** International law primarily emphasizes state sovereignty, making transnational cyberspace attacks and activism difficult to police and punish. However, Dr. Lucas Kello, Director of the Center for Technology and Global Affairs at Oxford states cyber incidents can be just as harmful as conventional acts of war. Efforts have been made to update cross-national laws and norms to account for cyber warfare, including:
    - The UN Group of Government Experts that recognized that sovereignty applies to 'state' activities in cyberspace;[87]
    - The 2018 Paris Call for Trust and Security in Cyberspace, a cross-sectoral effort by more than 1000 stakeholders, agreed on nine common principles to secure cyberspace;[88]
    - Efforts to curtail "malicious cyber activities" against NATO states have been promoted by CCDCOE;[89] and,

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[82] "Surveillance Drones." *Electronic Frontier Foundation*, n.d. https://www.eff.org/issues/surveillance-drones

[83] Brandon, John. "5 Uses for the Surveillance Robot of Tomorrow." *CIO*, August 13, 2014. https://www.cio.com/article/250282/5-uses-for-the-surveillance-robot-of-tomorrow.html

[84] Buchanan, Ben, and Andrew Imbrie. *The New Fire: War, Peace, and Democracy in the Age of AI*. MIT Press, 2022.

[85] Ibid.

[86] "Law of the Hague." International Committee of Red Cross, n.d. https://casebook.icrc.org/glossary/law-hague#:~:text=As%20opposed%20to%20the%20'law,Conventions%20of%201899%20and%201907

[87] "Protecting People in Cyberspace: The Vital Role of the United Nations in 2020." *United Nations*, December 2019. https://www.un.org/disarmament/wp-content/uploads/2019/12/protecting-people-in-cyberspace-december-2019.pdf

[88] *Paris Call*, n.d. https://pariscall.international/en/

[89] *NATO Cooperative Cyber Defence Centre of Excellence*, n.d. https://ccdcoe.org/

- The Global Cyber Alliance supported the creation of the Cybersecurity Tech Accord, the Paris Call, and the Cyber Peace Institute to implement better cybersecurity practices.[90]

- **Humanitarian action:** LOAC has developed through a series of international treaties, including the Hague Conventions, the Geneva Conventions, and the UN Charter. These laws protect specific groups during wartime, regulate the conduct of hostilities, and enact disarmament measures and arms control agreements.[91] Despite these efforts, the law has struggled to catch up with advances in technology, and there are still many weapons and types of warfare that fall outside its scope. There is a risk that new technologies will be used in ways that contravene the existing laws of war. For example, autonomous weapons systems (AWS) could be used to target and kill civilians, rather than just combatants.[92] AWS can target and kill people without human intervention, making it difficult to deploy humanitarian aid and uphold international humanitarian law. The development and use of new technologies must therefore comply with the existing laws of armed conflict, but also, there is an urgent need to update international agreements to govern the use, accountability, and liability of emerging technologies.[93]

- **Outdated laws:** Technology continues to progress at a faster rate than the regulatory frameworks put in place to manage it. AI and autonomous weapon systems, such as military robots and cyber-weapons, are creating challenges for the formulation, interpretation, and application of laws of armed conflict. The complexity of these new challenges, combined with the speed at which they are developing, complicate the application of the Geneva Conventions, which were created during a time before digital and cyber warfare. Similarly, issues of "clashing jurisdictional" control complicate the gathering, transfer, and use of data to further peace initiatives.[94]

INSTITUTIONAL POLICY

Outside of international courts, corporations are pursuing their own policies to regulate incendiary speech, hatred online, and the dual-use feature of some technologies. Currently,

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[90] Stifel, Megan. "The Importance of Civil Society in the World of Cybersecurity." *Global Cyber Alliance*, December 17, 2019. https://www.globalcyberalliance.org/the-importance-of-civil-society-in-the-world-of-cybersecurity/

[91] "Humanitarian aid past and present." *Oxford University*, n.d. https://www.elac.ox.ac.uk/programmes-projects/solferino-21/humanitarian-aid-past-and-present

[92] Cass, Kelly. "Autonomous Weapons and Accountability: Seeking Solutions in the Law of War." *Loyola of Los Angeles Law Review* 48 (2014): 1017. https://heinonline.org/HOL/Page?handle=hein.journals/lla48&div=37&g_sent=1&casa_token=GEkNXWadZHwAAAAA:8lPidE0CXz5UI_0wQpxWn1I2IUFau022NnAfFWrg_HdzFrxLrAKKu9gXDZ-NctmjVyHq8gli&collection=journals

[93] Ibid.

[94] Obendieck, Anke Sophia. "What Are We Actually Talking About? Conceptualizing Data as a Governable Object in Overlapping Jurisdictions." *International Studies Quarterly* 66, no. 1 (2022): https://doi.org/10.1093/isq/sqab080

these efforts are few and far between and raise concerns about internal regulation reach, enforceability, and transparency.

- **Hyperlegal warfare:** Professor Craig Jones has rightly observed that the modern era is striking for a remarkable "juridification" of war in which battle spaces are "saturated" by international law about the lawful conduct of hostilities and the protection of civilians, the wounded and refugees. His work shows how hundreds of 'war lawyers' play an ambivalent role in limiting war today.[95]

- **Private sector involvement in war efforts:** In response to the Russia-Ukraine war, companies including SpaceX provided satellite and communications services to the Ukrainian government on their own accord, outside of public parameters. While sharing these innovative technologies is helpful for addressing conflict, reliance on private technologies without adequate government oversight raises concerns over the longevity and reliability of these tools for peace efforts.

- **Policing of content**: In 2018, Meta (formerly Facebook) launched an Oversight Board to debate and provide the final ruling on content moderation issues.[96] The board is a response to calls for more accountability and responsibility for the content published on the site. Acting as an independent body, the Board is an amalgamation of global legal and technology experts who will help set universal norms for online content removal against the backdrop of differing jurisdictional norms and provide decisions in a neutral, transparent manner.[97] However, the Board has a limited perimeter of action (content removal) and does not consider misinformation, fake news, or false political ads.[98] As well, the outsourcing of content regulation can be seen as an abdication of Meta's responsibility to monitor its platform.[99] Critics also doubt the legitimacy of self-regulation and see the Board as an attempt by Meta to stave off true government regulation of platform content.

- **Regulating dual-use technologies:** Dual-use technologies are tightly regulated, with governments regulating their export to prevent their acquisition by adversaries. Ennis et al. (2019) note that "the current, well-established frameworks that control the flow of

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[95] "Warfare today and tomorrow." *Oxford University*, n.d. https://www.elac.ox.ac.uk/programmes-projects/solferino-21/warfare-today-and-tomorrow/#wtc

[96] Terjesen, Siri. "Why Facebook created its own 'supreme court' for judging content – 6 questions answered." *The Conversation*, May 5, 2021. https://theconversation.com/why-facebook-created-its-own-supreme-court-for-judging-content-6-questions-answered-160349

[97] Hofverberg, Elin. "Facebook's New "Supreme Court" – The Oversight Board and International Human Rights Law." *Library of Congress*, March 16, 2021. https://blogs.loc.gov/law/2021/03/facebooks-new-supreme-court-the-oversight-board-and-international-human-rights-law/

[98] *Oversight Board*, n.d. www.oversightboard.com

[99] Vaidhyanathan, Siva. "Facebook and the Folly of Self-Regulation." *Wired*, May 9, 2020. https://www.wired.com/story/facebook-and-the-folly-of-self-regulation

dual-use technologies coming out of the government or aerospace and defense industry may be less effective at controlling technologies that emerge from areas less traditionally associated with national security."[100] Thus, as AI and IoT become more ubiquitous and their applications more diverse, they also become more difficult to regulate. Scharre and Lamberth (2022) posit an AI arms control scheme featuring internationally agreed-upon inspections and limitations of AI system sizes, behaviors, and computing power can regulate the military use of AI.[101] However, many of the technologies that have dual-use potential are not necessarily developed with military applications primarily in mind. Commercial companies and/or academic institutions may develop these tools entirely for civilian purposes. However, since they can be used for both good and bad, it is important to ensure that they are not weaponized or used for violence.

[100] Ennis, Henry, Alan Estevez, Joe Mariani, Jessica Moran, and Joe Pauloski. "National security and technology regulation: Government regulations for emerging technology." *Deloitte Insights*, July 12, 2019. https://www2.deloitte.com/us/en/insights/industry/public-sector/national-security-technology-regulation.html

[101] Scharre, Paul, and Megan Lamberth. "Artificial Intelligence and Arms Control." *Center for a New American Security*, October 2022. https://arxiv.org/abs/2211.00065

ABOUT US

ABOUT THE GOVLAB

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