

Ethical Considerations When Using Geospatial Technologies for Evidence Generation

Gabrielle Berman, Sara de La Rosa and Tanya Accone

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Correspondence should be addressed to:

UNICEF Office of Research - Innocenti
Piazza SS. Annunziata, 12
50122 Florence, Italy
Tel: (+39) 055 20 330
Fax: (+39) 055 2033 220
florence@unicef.org
www.unicef-irc.org
[twitter: @UNICEFInnocenti](https://twitter.com/UNICEFInnocenti)
facebook.com/UnicefOfficeofResearchInnocenti

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GLOSSARY

Crowdmapping: The aggregation of crowd-generated inputs such as text messages and social media feeds with geographical data to provide real-time, interactive information on events (Wikipedia).

Contextual integrity: A concept developed by Helen Nissenbaum (2010), which identifies variables that underpin the exchange of data and, in turn, determine their true meaning or intent. These variables are (a) the particular context of a flow of information, (b) the capacities in which the individuals sending and receiving the information are acting, (c) the types of information involved, and what she calls (d) the 'principle of transmission' or the reason data is being sent and received (The Economist, 2007).

Demographically identifiable data: Data that may not personally identify an individual but enables them to be tracked or classified according to ethnicity, class, gender, age, health, location, occupation or other demographic data (Raymond, 2016).

Disclosure risk: The risk of uncovering an individual's personally identifiable information within a data set (Hundepool et al., 2010).

Geographic information systems (GIS): A suite of software tools for mapping and analysing data which is georeferenced (assigned a specific location on the surface of the Earth, otherwise known as geospatial data). GIS can be used to detect geographic patterns in other data, such as disease clusters resulting from toxins, sub-optimal water access, etc. (AAAS, 2017).

Geomasking: A method used to minimize disclosure risk, referred to as geographic masking, or geomasking. This approach alters a record's geographic location in an unpredictable way that is sufficient for preserving the spatial distribution of the variables while minimizing the possibility of identification of individuals (Allshouse et al., 2010).

GeoTagging: Adding geographical identification metadata (usually location data, i.e. longitude and latitude coordinates) to various media such as photographs, videos, websites and SMS messages

Global Positioning System (GPS): A network of U.S. Department of Defence satellites which can give precise coordinate locations to civilian and military users with proper receiving equipment (note: a similar European system called Galileo will be operational within the next several years while a Russian system is functioning but restricted) (AAAS, 2017).

Image capture payload: The actual images/information in transmitted data as opposed to automatically generated metadata (English Oxford Living Dictionaries, 2018).

Internet mapping technologies: Software programmes like Google Earth and web features like Microsoft Virtual Earth are changing the way geospatial data is viewed and shared. The developments in user interface are also making such technologies available to a wider audience whereas traditional GIS have been reserved for specialists and those who invest time in learning complex software programmes (AAAS, 2017).

Metadata: Metadata summarizes basic information about data, which can make finding and working with particular instances of data easier. For example, author, date created and date modified and file size are examples of very basic document metadata. Having the ability to filter through that metadata makes it much easier for someone to locate a specific document (WhatIs.com, 2018).

Open source: software for which the original source code is made freely available and may be redistributed and modified.

Remote sensing: Imagery and data collected from space or airborne camera and sensor platforms. Some satellite image providers now offer images showing details of one meter or smaller, making these images appropriate for monitoring humanitarian needs and human rights abuses. Remote sensing technologies include convention radar, laser altimeters, altimeters, acoustic ultrasound, aerial photographs, hyperspectral imaging and multispectral platforms (AAAS, 2017).

Synthetic Aperture Radars: A radar system that uses the motion of the vehicle (such as a spacecraft) carrying it to simulate a system with a much larger antenna area and that is used to obtain high-resolution images of a surface (such as of a planet) (Meriam Webster, 2018).

File transfer protocol: A standard network protocol used for the transfer of computer files between a client and server on a computer network.

ACRONYMS

| | |
|-----------|---|
| UAV | Unmanned aerial vehicle |
| 4W Matrix | A 4W matrix (Who, What, Where, When) is used to gather information to coordinate needs and responses in humanitarian contexts |
| GIS | Geographic Information Systems (software) |
| GPS | Global Positioning System |

INTRODUCTION: GEOSPATIAL TECHNOLOGIES FOR DEVELOPMENT AND HUMANITARIAN ORGANIZATIONS

Geospatial technologies refer to technologies used to acquire, manipulate, store and visualize geographical information.¹ These technologies provide information on where individuals, groups and infrastructure are located in time and space.

For development and humanitarian organizations like UNICEF, the value of these technologies includes the ability to collect and process real-time information from places that are hard to reach or navigate such as dense forest, conflict zones, or where environmental disasters are occurring or have occurred. Geospatial technologies such as remote sensors² provide a valuable aid in visualizing hard to reach or dangerous locations. They provide a means to safely identify the scale of damage from disasters and conflicts or the pace of recovery. They are used to facilitate monitoring of the distribution of goods such as tarpaulins or tents, to identify and analyse temporary settlements and to track the displacement or movement of people.³ They are also used in disaster management to model potential environmental impacts thereby enabling more targeted planning.

Geographic information systems (GIS) software is capable of analysing and visualizing large quantities of data to identify correlations, trends and patterns in relation to geographical location. The data used for this modelling and, frequently, the analysis of this data may be provided and undertaken by social media and telecommunications organizations, providing a relatively cheap means to generate evidence, particularly for larger geographical areas. Further, analysing databases of this magnitude can provide insights that could not previously be gleaned/acquired using traditional offline data collection methods.

The advantages of geospatial technologies and resulting data⁴ however, also present ethical dilemmas such as privacy and security concerns as well as the potential for stigma and discrimination resulting from being associated with particular locations. As a global agency responsible for upholding the rights of children, UNICEF needs to ensure the protection and respect of these rights in all that we do. While the data collected and used may not always be differentiated or categorized by age, there is no doubt that children and their communities will be captured through the use of these technologies and data.

Therefore, the use of geospatial technologies and the resulting data needs to be critically assessed through an ethical lens prior to implementation of programmes, analyses or partnerships. Using this lens requires not only explicit consideration of potential negative consequences of adoption but also clear articulation of the specific contexts and conditions under which benefits may be realized.

To support this process, this background paper is divided into four sections. Section One provides an overview of some of the benefits of using geospatial technologies and resulting data for development and humanitarian based organizations. Section Two reflects on potential risks inherent in the use of these technologies, the data collected and the analysis applied. Section Three builds on the previous

1 Dempsey, C., 'What is the Difference Between GIS and Geospatial?' GIS Lounge, 14 January 2014, available at <https://www.gislounge.com/difference-gis-geospatial/>

2 including satellite technologies and unmanned aerial vehicles with electro-optical, infrared, multispectral or hyperspectral sensors

3 Gilman, D., 'Unmanned Aerial Vehicles in Humanitarian Response', OCHA Policy and Study Series 10, June 2014.

4 For the purposes of this brief, data includes both coordinate and visual data.

two sections to explore the ethical considerations that need to be reflected on in the implementation of programmes involving geospatial technologies to ensure ethical evidence generation.

Section Four comprises a Checklist for Ethical Use of Geospatial Technologies for Evidence Generation. The checklist provides questions that need to be considered and reflected on in consultation with relevant stakeholders and experts to ensure the benefits of these technologies are realised while also ensuring that children and communities are protected.

THE BENEFITS OF USING GEOSPATIAL TECHNOLOGIES FOR EVIDENCE GENERATION

There are multiple ways in which both visual and coordinate data from geospatial technologies support various phases of development programming and humanitarian aid. These include:

- Disaster risk preparedness and mitigation
- Public information and advocacy
- Real-time monitoring and situation analysis
- Coordination and health surveillance
- Crowd mapping

The various applications of geospatial technologies and contexts in which they may and are being used include:

Disaster risk preparedness and mitigation (includes: GIS and satellite, drones with electro-optical, infrared, multispectral or hyperspectral sensors). GIS analysis can be used in disaster management to model potential environmental impacts, thereby enabling more targeted planning and potentially reducing the impacts on infrastructure and persons (Rodríguez-Espíndola, 2016).

Public information and advocacy (includes: GIS, satellite, remote sensing, drones with electro-optical and infrared cameras). These technologies can be used to see and show the scale of damage caused by conflict or disasters as well as the pace of recovery, or to highlight specific problems in relation to infrastructure or mobile populations (Gilman, 2014, p.6). In addition, these technologies can facilitate the documentation of atrocities and human rights abuses, providing evidence of war crimes (Gilman, 2014).

Real-time monitoring and situation analysis (includes: GIS, satellite, remote sensing, drones with video monitoring equipment). Some geospatial technologies can be used to provide timely and high-resolution data from diverse data sources allowing for situational analysis and insights into what people do and how communities cope during disasters and other humanitarian situations.

Case study: Inter-Agency Mapping Platform Lebanon

Beginning in 2011 with the outbreak of the Syria Crisis, Lebanon has seen a massive influx of displaced Syrians. As a result of a long-standing government policy, formal camps were not established to host the displaced population. As such, displaced Syrians have been settling within Lebanese communities in informal settlements, collective shelters, private rental accommodation and other shelter solutions throughout the country.

The dispersed nature of the refugee population posed a unique set of challenges for the humanitarian response. First and foremost, there was a substantial challenge in simply keeping track of where refugees were located and how many were in different types of settlements. Second, due to the lack of a common method of uniquely identifying settlements, coordinating actions between operating partners was extremely difficult.

Various initiatives arose out of these needs, but efforts were largely uncoordinated and resulted in incomplete and inconsistent coverage as well as duplicated coverage and multiple naming schemes for the same communities.

Medair was one not-for-profit organization providing solutions to this issue. One of its initiatives, located in the Bekaa valley, used ArcGIS Online – an online, cloud-based geographic information system (GIS) to support Lebanese agencies in this region. The software was designed to establish a single system that created and shared maps and data. The software mapped the informal settlements using all the spatial data available pertaining to sites previously identified and collected by various agencies and implementing partners. From this, a coding system to uniquely identify these settlements was created, thereby facilitating the construction of a set of baseline data about where settlements were, how many people lived there and other basic information.

The initiative was so successful that UNHCR decided to roll out the system nationwide with some modifications across different areas to account for differences in scale and context. Based on the previous experience with the initiative in the Bekaa, the programme was expanded to ensure the coordination and national mapping of informal settlements for each region of the country.

The data set from the mapping platform can be used for improved targeting, coordination, baseline information and other purposes. For instance, using the system, agencies have and will continue to be able to more easily identify where they are working, both internally and amongst partners.

Beneficiaries themselves can also use this system to self-identify their locations, allowing them to better inform and liaise with operating partners.

The public, academia and media will be able to use the information to broadly inform their work and understanding of the situation in Lebanon. There is also potential for more sophisticated research and analysis.ⁱ

ⁱ Taken directly from Inter-Agency Coordination Lebanon (2015) *Inter-Agency Mapping Platform (IAMP): Standard Operating Procedures*

Images from monitoring equipment (including but not limited to phones, infrared systems and synthetic aperture radars) attached to unmanned aerial vehicles (UAVs) can also be used for:

- Rapid assessment of damage, such as collapsed buildings or blocked roads
- Monitoring distribution of goods, such as tarpaulins or tents
- Identifying and analysing temporary settlements or tracking displacement or movement of people (Gilman, 2014)
- Monitoring movements of armed groups

These visual technologies are particularly useful in instances where access to an area is limited by natural or political hazards.

Coordinate data provided by private enterprises and derived from either Global Positioning System (GPS) data from mobile devices or from analysis of social media content can also provide information relating to population movements, which is critical for resource allocation and planning in emergencies.

Case study: Real-time situational awareness of water sanitation and hygiene (WASH) management in refugee camps

In September 2017, the eruption of Vanuatu's Monaro volcano caused the evacuation of approximately 11,600 persons from Ambae island. Vanuatu's UNICEF office, the Ministry of Health, WASH experts and responders cooperated to collect data to help manage the evacuation of camps across the neighbouring islands. In light of their ability to provide visuals of inaccessible or dangerous terrain, drones were used to collect data in order to map the refugee camp layout and to help decision makers to plan the allocation of water purification plants, toilets, etc. <https://reliefweb.int/report/vanuatu/vanuatu-monaro-volcano-unicef-pacific-humanitarian-situation-report-28-september-05>

Coordination and health surveillance. In order to ensure a well-coordinated response, UN and non-UN agency humanitarian clusters work together to deliver humanitarian assistance in key areas such as health, education and water. GIS software enables data analysis and visualization of large quantities of data inputs to identify correlations, trends and patterns in relation to their geographical location. GIS has transformed agencies' capacities to communicate the full scope of humanitarian work accurately, openly, comprehensively and in a visual and timely fashion (Sherman, 2012). For organizations with a limited budget for software licenses, open source GIS software can be used to reduce overhead costs and ensure all relevant agencies can effectively engage with coordination efforts and/or reap the benefits of GIS systems. With this proliferation of high quality open source software and with software companies such as Microsoft building functionality into their pre-existing suite of programmes (such as Excel and Power BI), GIS software is becoming a faster, more accessible, user-friendly and cheaper tool to support coordination and health surveillance.

Case study: Using GIS to map and share data in humanitarian contexts. UNICEF in Somalia (based on Okoth and Ngigi, 2014)

A 4Wⁱⁱ matrix (Who, What, Where, When) is frequently used in humanitarian contexts and updated regularly with the latest data. In Somalia, each agency providing humanitarian assistance requires the latest copy of the shared 4W matrix to ensure a well-coordinated response to any emergency. In order to make sense of the information and see the spatial distribution of the programmes, the data in the 4W matrix needs to be visualized.

UNICEF Somalia adopted a prototype web application for sharing geospatial information using data from the 16 districts of Mogadishu city. A 4W matrix was created and the data presented on an open source platform that allowed for sharing of geospatial data.

Stakeholders and agencies from different geographical locations were then able to keep track of the programmes being implemented in Somalia. The platform facilitated spatial queries relating to programme variables (i.e. 4W variables) with the results obtained displayed on a map. This mapping helped inform near real-time allocation decisions on the ground while also providing a quick and effective means to show donors the current status of programmes being implemented.

ii 4W = Who, What, Where and When. The 4W matrix is jointly populated and used by partner organizations to gather information to coordinate needs and responses in humanitarian contexts.

Case study: The Magic Box Initiative (combining data from UNICEF GIS with other data sets)

The Magic Box Initiative has created a 'Big Data for Social Good' platform which collects real-time data, combining and analysing aggregated and anonymized data from both public sector organizations and private sector companies (via their application programming interface). Data from companies like Telefonica Colombia, Amadeus (Travel) and IBM, have been combined with public data sets to provide up to date insights and surveillance that can be applied to public health emergencies, natural disasters and emergency contexts.

Magic Box was used to respond to the Ebola crisis in West Africa and to the spread of the Zika virus in Latin America. By combining real-time data sourced from the private sector, existing public data sets relating to climate, UNICEF's GIS and socioeconomic and epidemiological data, it was possible to track the spread of the diseases to improve the targeting of responses to facilitate containment, advocacy and service provision.

Crowdmapping. Crowdmapping facilitates the monitoring and mapping of rapidly changing events or unreported incidents and their geography. It can provide data in instances where accessibility was previously not possible, where volatility or lack of security and danger created impediments to comprehensive data collection or where previously there was a deterrent to face-to-face reporting. Examples include: using crowdmapping to track movements of persons (internally displaced people or IDPs) in a conflict zone; monitoring areas of high incidence of violence against women and children; or mapping areas (and particularly poorer areas) that have never been mapped before.

Crowdmapping using secure platforms and file transfer protocols may be particularly valuable not only as an approach to understanding the geospatial distribution of social problems such as the areas of high incidence of violence against children and women, but also as a means to indirectly give those affected a voice. This is particularly important given that under-reporting of violence against children is common. Fear of an abuser is one of the primary determinants of under-reporting, which

may be compounded by the fact that traditional reporting systems can be overly bureaucratic, slow and stigmatizing (SRSG, 2012). The possible anonymity that can be provided by mobile or web-based reporting can provide a vehicle to allow people, including children, to report on and speak about sensitive subjects (including abuse) in locations where these issues remain taboo and/or informally sanctioned by social norms (Moestue and Muggah, 2014). Crowdmapping can be an effective tool in providing information on the locations of violence, including violence against children, thereby providing important information for advocacy, service delivery and prevention.

Crowdmapping can also facilitate the mapping of large, insecure and/or dense geographical areas by mobilizing and micro-tasking significant numbers of on the ground volunteers. It must be acknowledged however that the value of the mapping is therefore contingent on the quality and quantity of information provided and, in contexts where maps are created for geographical navigation (rather than determining prevalence, incidence or population size), on the systematic coordination of volunteers to prevent duplication and facilitate appropriate coverage.

Case study: HOT – Humanitarian OpenStreetMap Team (www.hotosm.org)

HOT uses a significant network of volunteers to create maps online that enable responders to reach those in need in the context of humanitarian disasters. In undertaking this role, it responds to the needs of the poorest and most vulnerable in places that do not exist on any map. To date, over 3,500 Missing Maps volunteers have collectively made 12 million edits to the Open Source OpenStreetMap (a free, editable map of the world) and mapped previously undocumented geographical areas where roughly 7.5 million people dwell. HOT supports community mapping projects around the world and assists people to create their own maps for socio-economic development and disaster preparedness.

Case study: Kathmandu Living Labs (www.kathmandulivinglabs.org)

After working with HOT post the 2015 Earthquake and recognizing the utility of filling in the many blanks that existed within the map of Nepal, Kathmandu, Living Labs trained local individuals to undertake community mapping on the Open Source OSM platform. To date, these volunteers have mapped more than 2 million buildings and 135,000 kilometres of roads, literally putting marginalised communities on the map. The images below show the difference this ‘Map for Everyone’ initiative has made.



THE POTENTIAL RISKS IN USING GEOSPATIAL TECHNOLOGIES FOR EVIDENCE GENERATION

While geospatial technologies and their capacity to determine and map locations of individuals, events, terrains and infrastructure can bring about significant benefits, there are risks in their generation, collection and sharing, and in the decision-making process based on the analysis of any resulting numerical or visual data.

In the case of a repressed minority, the tracking of location could result in discrimination as the knowledge could lead to people's harassment. And just as location-aware services could help a group gather, they could also be used to impede association or assembly, depending on who had access to the data and what kind of forces they could exert to stop a gathering. Even the threat of location surveillance could have a chilling effect and stop people from assembling. (Rundle and Conley, 2007)

The following are the key potential risks of using geospatial technology for evidence generation:

- Privacy, security and surveillance issues relating to the capacity to directly or inadvertently observe private property, capture sensitive personal information and potentially put persons in harm's way
- Privacy and safety risks related to transmission, sharing and storing of geospatial data
- Uncertain consent when using data from third-party providers
- Negative political associations with visible data capture devices like UAVs equipped with a camera/image capture payload
- Unintended or unknown surveillance
- Lack of representativeness, robustness or usefulness of data
- Discrimination can be consciously or unconsciously built into algorithms – without the final user's knowledge.
- Data collection from smart devices may be disproportionately present in more affluent neighborhoods and has been shown to reinforce inequitable public service/resource allocation.
- Data stored on servers could be accessed or stolen by governments, militants or malicious parties.
- Data may not be appropriately or fully disposed of and remain on servers or other hard drives, both known and unknown.

Privacy, security and surveillance

The following outlines the key privacy, security and surveillance issues raised by use of geospatial technologies and their data:

Surveillance and privacy. Visual data capture from remote sensing technologies has the capacity to directly or inadvertently observe private property and capture sensitive personal information, violating individuals' privacy and potentially placing them in harm's way (Gilman, 2014).

The nature of surveillance and privacy risks differs according to the nature of the data captured and the mechanism for capturing this data. Each of the following data capture processes and attendant data can and have been used within development and humanitarian contexts generated by partners or by the organization itself.

Data captured through geospatial tagging via social media: In these contexts, the individual has, to some extent, a degree of control over the geospatial data provided. Most individuals do this consciously, choosing to tag themselves to identify their location. However, users may be less aware of the steps necessary to disable the automatic geotagging of the photos and videos they take with their cellphones and to prevent metadata from being made available every time they post these on social media. They are further at risk when others tag or visually capture them and inadvertently identify their location. There are options for the individual to de-tag themselves however this requires awareness of having been tagged.

Other geospatial data generated and captured from mobile devices (that is not necessarily derived from geotagged data) such as call volumes, call frequency and location i.e. call detail records. This is personal information that is typically collected and analysed in aggregate. There can be no informed consent for sharing of this information by virtue of the fact that it is captured largely in aggregate. However, it does raise issues with respect to control of data and respecting those whose data is used. Providing publicly available information regarding its use would be a means to respect those whose data is contained in the database.

Visual data captured through remote viewing, UAVs/drones and satellite technologies: In these instances, the person or groups involved may not be aware of this invasion of privacy or, if they are aware of this violation of their privacy, are unlikely to be able to mitigate against it or be easily able to take remedial action in real time or retrospectively. There is little possibility for individuals or populations to provide informed consent for this type of data collection and therefore for any subsequent analysis, use or dissemination and sharing of the data.

Georeferenced data collection: In these instances, geolocational data is directly collected from persons as part of broader data collection/survey processes. The georeferenced data sets could give rise to disclosure risks. These risks relate to the potential for an individual's identity to be exposed in the release of a georeferenced data set. The risks of this occurring are increasing as it becomes increasingly possible and easier to link published health and other administrative data back to individuals using their geographical location (Hampton et al., 2010).

It is worth highlighting that some of the risks related to surveillance and privacy may be minimized if data sets are de-identified, aggregated to a sufficient level and/or, if possible, geomasked. In the case of visual data, these risks may be mitigated if it is of sufficiently low resolution or appropriately

distanced, as long as data transfers are secure. The efficacy of de-identification and aggregation strategies however, are contingent on geographical distribution and density of populations, point of access of data by third parties (i.e. when third parties actually access the data pre or post de-identification) and the capacity for re-identification using other data sets. In relation to visual data, the resolution and distance are contingent on the needs and purposes of the data to be collected. It should be noted however that there are limitations to the efficacy of de-identification at the personal level because in certain instances, such as population tracking, interception of visual data identifying groups may be just as risky as identification of individuals.

Privacy and safety related to transmission, sharing and storing of geospatial data. Comprehensive privacy, data protection and storage standards may be largely non-existent in many countries where geospatial data is being collected. This is particularly problematic in development and humanitarian contexts where data is frequently shared between agencies, donors and NGOs. Further, data may be directly or indirectly shared with (or accessible by) the private sector and/or the state, neither of which may be bound by human rights and/or humanitarian standards. Access to this data may be the result of formal contractual or political agreements and/or the consequence of transmitting sensitive information over insecure mobile networks or using platforms where privacy can be compromised via coercion or hacking.

Consent and data use from third party providers. Geolocated information derived from third party sources such as social media or telecommunications companies is unlikely to have been collected from those who had provided informed consent for this secondary use of the data. While contractual provisions may have allowed for on-sale or sharing of data, it would be hard to argue that consent for this particular use of this data (even aggregated in an anonymized way) is truly informed.

Negative political and cultural associations with visible data capture devices like UAVs. Unmanned aerial vehicles, also known as drones, may have profound negative political and cultural connotations and associations. Populations that have been exposed to authoritarian regimes or armed conflict may perceive UAVs as evidence of spying and/or collaboration with these actors. Thus the use of UAVs, even for beneficial data collection purposes, may affect local humanitarian and development efforts and potentially put humanitarian actors at risk. Further, any operation of UAVs requires prior consent from government and civil aviation authorities (depending on the country, military/MoD should also be involved). Irrespective, there are risks to operating drones in countries with a history of or current authoritarian regimes and even in contexts where this may be absolutely necessary, neighbour country support or NATO would usually be involved.

Community outreach and acceptance campaigns for visible aerial capture devices like UAVs

One measure implemented by UNICEF (in partnership with local government) to manage potential negative associations with visible aerial capture devices like UAVs (in politically stable contexts) has been the launch and coordination of community awareness campaigns. This is being undertaken across regions where implementation of new technologies such as drones is being planned. This is particularly important in countries where there are still strong cultural and local religious beliefs in witchcraft or natural spirits.

Examples of this approach can be seen in Malawi and Vanuatu (Pacific Islands) where the UNICEF Office of Innovation is supporting drone programmes. In both contexts, there are a variety of cultural and religious communities that have different beliefs and interpretations about “objects flying in the sky”. One such notable example is the cargo cult that exists in Vanuatu, Tanna island, where locals have come to recognize and celebrate pilots and those emerging from air vehicles as gods.

<http://www.atlasobscura.com/places/cargo-cults-tannalocal>

To address misconceptions, both Malawi and Vanuatu UNICEF country offices, in partnership with the respective governments, coordinated extensive campaigns over several weeks to reach out to communities (i.e. via theatrical shows in local language including flight demonstrations using a small drone) to explain the drone technology; and to bring reassurance to communities and children that these technologies are not linked to negative spirits but that they are expected to bring benefits (i.e. by finding people in need as part of flood response and search and rescue operations or by delivering essential medical supplies such as vaccines, etc.)

https://medium.com/@unicef_malawi/remote-malawian-community-sees-a-drone-for-the-first-time-ccd4ec645b93

<http://unicefstories.org/2017/06/14/vanuatu-launches-pacifics-first-drone-trial/>

Unintended or unknown surveillance. An individual’s geospatial data is also available by default via the GPS receiving capabilities of smartphones. This feature can facilitate surveillance by third parties including applications companies and their affiliates, governments (either through legitimate or illegitimate means) or other nefarious individuals or organizations (for political or criminal purposes). This capacity for surveillance is further problematized by the fact that applications and data stored on mobile phones are less protected from unauthorized access than on most desktop and mobile computers (Ben-Asher et al., 2011). As noted above, geospatial data collected, whether for good or nefarious purposes, will be unlikely to have received truly informed consent for its use.

Security in the context of crowdsourcing. There may be instances where individuals and possibly children put themselves in unsafe conditions in order to participate in crowdsourcing activities. For example, when participating in crowdmapping, individuals may enter into unstable or unsafe environments in order to map previously unmapped areas (Cebrian, 2016).

Expectations of rectification, restoration and rejuvenation of areas mapped. Those involved in crowdmapping, if not appropriately briefed, may have expectations of direct and immediate rectification of environmental hazards and restoration and rejuvenation of local areas mapped. If not addressed prior to commencement of the intervention, this may jeopardize the ongoing relationship with the community of participants and may potentially prevent further mapping.

Data-related risks^{5,6}

There are a number of risks that need to be considered relating to the use of geospatial technologies to generate data for evidence. These risks pertain to each phase of the data cycle from collection, processing and sharing to the analysis and finally the use of data for decision making and assessment. They may be as relevant for online as for offline data processes. The risks at each phase of the data cycle include:

Collection

- Lack of representativeness of the data. Data collected on a particular platform will reflect the population of users of that platform. In the instance of social networking sites developed for smartphones, this will exclude populations that do not have access to this relatively more expensive technology. The exclusion of particular cohorts (say children under 13) means that the findings may not always reflect the scale and scope of populations within particular geographical settings.

Processing

- Indirect data collection (i.e. data collection undertaken by third parties) means that inference of specific insights relating to geography is less straightforward given that the quality and validity of the data cannot be directly assessed. This implies that insights may need to be interrogated and qualified, with explicit reflection on the strength of the explanatory power of the model.
- Revelation of personally identifiable information (PII). Even if initially de-identified, geodata that is subsequently combined with other databases may lead to clear identification of individuals. It is extremely difficult (arguably impossible) to guarantee that a certain type of anonymization will hold over time since new data sources might be released by third parties that could compromise the security of any system (Sweeney, 2002; De Monjoye et al., 2013).
- Lack of Transparency. The processes used by third parties (data collectors such as social media services) to 'clean data' can lack transparency leading to uncertainty in relation to omitted variables, representation and consistency in data sets.
- The time required to clean and validate data sets so that they are useable and in a format that is understandable to those on the ground may make third party geospatial data use redundant or counter-productive, particularly where information is time sensitive.
- Secondary data provided by a third party may be analysed and used for contexts which differ from the original context, intent and audiences for which it was originally provided or shared. In certain instances, this discrepancy may result in lack of contextual integrity with its true meaning and intent lost. Consequently, the findings may be spurious. Further, in the context of data from social media platforms, the findings will be based on stated preferences which may not actually represent real preferences.

⁵ Largely informed by Verhulst, S., (2017) Presentation to UNICEF Office of Research – Innocenti, 27 April 2017, Florence.

⁶ It should be noted that some of the risks, such as the amount of time required for data cleaning, are equally applicable to offline data collection and non-geospatial data collection processes.

Sharing

- Lack of data stewardship. Unless formalized in memorandums, contracts or institutional practice, PII may not be sufficiently protected without a clear agreement between partners relating to its responsible use that seeks to protect and limit access to this type of data.

Analysing

- As with all forms of data analysis, poor problem definition can lead to data being analysed in a way that does not add value and therefore diverts time and resources.
- Inappropriate data modelling undertaken by persons who do not take into account the limitations of the data and/or do not understand and take into account the social, political and environmental contexts in which the data was collected, can lead to bias and inaccuracies in predictions, trends and consequent decision making based on these flawed findings.
- Discrimination can be consciously or unconsciously built into algorithms without the final user's knowledge. Geography and the relationship between location, poverty, gender and race may result in trends and predictive models that discriminate against certain persons and populations in particular locations. Examples include algorithms used for police profiling, judicial decisions, access to educational opportunities and insurance. Machine learning-based algorithms might have unintentional but discriminatory outputs that would reinforce disparities in data collection/service allocation.
- **Dependence on ICT Infrastructure.** Geolocational data generated by volunteers and/or obtained via third party data (frequently provided by private organizations such as social media and telecommunication companies) may be susceptible to incorrect inferences if the data set is incomplete, inaccurate or unrepresentative. Outdated local infrastructure, inconsistent access to electricity and government blocking of platforms and apps may make geospatial information collected not only more susceptible to security breaches but also likely to be incomplete or insufficient for decision making (Nyst, 2013; Moestue and Muggah, 2014). These issues may be particularly problematic in the context of humanitarian emergencies and within authoritarian regimes.

Using

- Discrimination, stigmatization, economic loss. Geographical data and modelling identifies trends in locations. However, it does not necessarily reflect individual cases that may be affected by decisions based on these trends. While this is necessarily true of most policy and population based decisions, decision making using geospatial data is frequently captured within big data, which is largely removed from human scrutiny and left to algorithms, potentially resulting in unconscious discrimination against individuals by commercial, government and international and national NGOs in the absence of specific reflection on the individual case.
- In a number of contexts, smartphones may be more likely to be owned and used by persons in more affluent neighbourhoods. This may reinforce inequitable public service/resource allocation if allocation is based on analysis of information received via smart devices. In other words, in affluent

neighbourhoods there may be more smartphones present and more people educated in how to use smartphones to register neighborhood problems, potentially providing a signal to authorities of a high concentration of need. Conversely, less affluent neighborhoods (or population groups) where smartphone ownership and use/education rates are lower would generate less data. This could be construed as a lesser demand for services, repairs or infrastructure in these areas, when, in fact, there is an absence of means and awareness of how to notify authorities of these issues. Hence, even in the absence of complex algorithms, geographical data can lead to inappropriate service delivery when the data provided is not representative.

- As is the case for all types of data collection and analysis, if the data quality is poor or unrepresentative then the generalizability of the findings is likely to be limited, requiring significant caveats and identification of populations omitted when findings are presented.
- The population under inquiry may be unaware that policies, programmes and actions are based on simple or complex geographical modelling (for further discussion on discrimination and big data see Ethical Issues when Using ICT Innovations for Evidence Generation Paper No.1) and hence will be unaware of any inherent discrimination in individual or population based decision making. This prevents any legitimate queries, restitution or disputation of decision making, thereby precluding accountability in decision making.

Storing

- A social media company, its affiliates and support services' servers could be hacked so that data generated through organizational programming is temporarily or permanently inaccessible. In time-sensitive contexts, this could have significant implications, particularly in cases where 'on the ground' decision making is strongly dependent on this data.
- Personally identifiable data or demographically identifiable data stored on servers could be accessed or stolen by governments, militants or malicious parties through hacking, backdoors or legislation, irrespective of the location of the data provider and the protective legislation in their home country. This is true whether storage is cloud-based or on a local server.

Disposing

- The primary risk relating to disposal of data is that the data is not appropriately or fully disposed of and that it remains on servers or other hard drives, both known and unknown.

ETHICAL CONSIDERATIONS WHEN USING GEOSPATIAL TECHNOLOGIES FOR EVIDENCE GENERATION

The following guidance should be considered prior to using geospatial technologies for data collection and use.

Reflecting on and maximizing the benefits

- Be clear how the data collected or the mapping undertaken using geospatial technologies will specifically address or concretely inform policy, programming or advocacy needs within the local context.
- Assess the benefits of using geospatial technologies for data collection in the context of pre-existing information sources and/or the viability and resource implications of alternative data collection mechanisms.
- Collect evidence wherever available identifying the explicit benefits of the technologies and the appropriateness of the data collection method.
- Collect only data that is necessary. To the greatest extent possible, reflect and plan for the data collection within strategic planning processes.
- If third party data or consultancy expertise is to be used, ensure that a non-disclosure agreement is included in the procurement process and that experts are briefed on any relevant, organizational ethical procedures and requirements pertaining to privacy.
- **Ensure that there are sufficient numbers of qualified staff and/or time and resources** to produce meaningful and timely information.

Ensuring privacy and security

- **Acquire consent where relevant and feasible.** If the project is likely to capture personally identifiable data then, wherever possible and feasible, informed consent should be obtained in advance. If this is not possible, information on the project should, at a minimum, be provided on the organization's or office's webpage and/or the landing page on social media.
- **When receiving secondary data, take into account data providers' expectations regarding the privacy of data.** Care should be taken in the use of this secondary data, reflecting on the context in which the data was collected, the nature of the population whose data is being analysed, the information used, the likelihood of identification of individuals and the degree to which expectations of privacy can be met.
- **De-identify personal data (incl. visual data) to the greatest extent possible and as soon as possible.** Disaggregate geographical clusters to the strict minimum needed, adopt the weakest possible visible resolution (i.e. maximum useful distance for visual data), remove identifying information and/or obscure visual details, while maintaining the usefulness and meaningfulness of the data for programme, policy and decision-making purposes.
- **Consider using geomasking techniques to mitigate against re-identification of individuals in data sets produced.** Discuss the value of geomasking for your project with the geospatial experts involved.

- **Review visual data as soon as possible to ensure** that identifying information is not shared nor made public.
- **Build in privacy by design.** Wherever possible, when developing a project involving geospatial technologies ensure that privacy concerns are identified and mitigated against in relation to the software used, the transmission channels, the storage built/used and the platforms for dissemination.
- **Consider the privacy policies of third-party geospatial data providers (such as social media services).** When using third-party data, consideration should be given to the privacy policies of the organization and their implications including (where relevant):
 - Anonymization and aggregation of data provided by the third party
 - Safe transmission mechanisms for data (e.g. encryption used at all times when data is being sent from one party to the other)
 - Whether there are clear conditions evidencing respect for individuals' rights relating to their data. This could include consent arrangements for non-operational use of data, notification of potential sharing of data (including information about with whom it may be shared), right to removal of personal data from data sets, etc.

When deciding (a) whether to use the third-party data and (b) whether it is feasible or appropriate to create an MoU to ensure privacy and security in the transfer and receipt of data or analysis.

- **Wherever possible only de-identified geospatial data should be accepted from third parties in place.**
- **If deciding to proceed with a partnership to accept geospatial data from third parties, then measures should clearly be taken to publicly acknowledge the nature of any partnership and the safety measures taken to protect the privacy of those whose data has been used.**
- **Carefully consider the risks, benefits and alternatives if the potential partner is incorporated or subject to the legislation in a country with broad surveillance powers** and a history of (a) gross violations of individual privacy and/or (b) interrupting national access to media channels including social media. In other words, consider the reach of the relevant government in terms of access to or blockage of use of technologies.
- **Establish an agreement/MoU with service providers or volunteer organizations clarifying arrangements for** data sharing and personal identity protection arrangements, including what procedures to follow if community consent is needed.

Understanding data risks and limitations

- **Understand potential limitations in the data.** Limitations of the data could include: data gaps, who is included or excluded from the data (pertaining to accessibility of technologies, devices and profiles and demographics of participants), merging of incompatible databases/data sets, inclusion of outdated data, etc. Any limitation of geospatial data (whether collected directly or indirectly through a third party) should be understood. Discussions should be had with data providers and data experts on these limitations in order to:
 - Understand whether the data is fit for purpose
 - Ensure that any findings are appropriately qualified with clear consideration of the implications of the limitations
 - Ensure that recommendations based on findings are similarly qualified with clear consideration of the implications of the limitations

- **Consider the possibility of discrimination against disadvantaged groups that are collectively associated with particular geographical areas.** Correlations between particular populations in light of factors such as their geography and the relationship between location, poverty, gender and race may result in geographical trends and predictive models that discriminate against certain persons in relation to their access to services and their opportunities. Where discrimination is a possibility, the use of geospatial technologies and data should be reconsidered and/or any resulting decision making should be carefully triangulated with other data sources.

Assessing and managing the risks

- **Use a risk assessment framework.** In light of privacy and security risks and potential data limitations, prior to adopting geospatial technologies for evidence generation or embarking on a partnership for the provision of data for GIS modelling from third parties, a risk assessment should be undertaken. This requires an assessment of risk profiles relative to the potential benefits to relevant communities. The checklist provided in this brief can be used as a very basic risk assessment tool. Other tools include:
 - A risk assessment tool created by the UN Data Privacy Policy Group that can be adopted and adapted
<http://unglobalpulse.org/sites/default/files/Privacy%20Assessment%20Tool%20.pdf>
 - The Information Accountability Foundation (2016) Big Data Assessment Framework and Worksheet
<http://informationaccountability.org/wp-content/uploads/IAF-Big-Data-Ethics-Initiative-Part-B.pdf>

- **Make contingency plans.** Include in any risk assessment appropriate contingency plans in the event that (a) access to technologies or infrastructure is blocked or breaks down unexpectedly, (b) data is wiped remotely, or (c) a privacy breach occurs.

- **Consider providing training or tips on potential risks and protection strategies for individuals involved in a crowdmapping exercise.** Individuals should be informed about how to conduct themselves safely in the physical environment, the ethics and risks of capturing others in any photography used in the exercise, what types of sites should not be photographed or entered (e.g. certain government buildings or locations where criminal activity takes place) as well as possible online risks.

- **Manage expectations** in relation to assumptions that mapping areas will directly and immediately result in rectification of environmental hazards and restoration and rejuvenation of local areas.

Engaging communities in risk assessment and sharing of findings

- **Collaborate with all relevant stakeholders to populate a risk assessment framework.**
- **Share Findings.** Findings of the data should, wherever possible and appropriate (without compromising privacy or security), be shared with the communities involved.

Using unmanned aerial vehicles: Engaging communities and being sensitive to perceptions

- **Ensure communication and engagement with the community** prior to use of visible devices like UAVs to prevent misunderstandings as to the nature of the device and the purpose of its use.
- **Launch and land a UAV from the location to be surveyed** rather than remotely⁷ to highlight transparency in use and allow for an opportunity for appropriate explanations and dialogue with the community in advance.
- **If a UAV landing is to be remote, ensure a recovery team is available at the remote site** so that the UAV (and data collected) do not fall into the hands of wrong people.
- Unless absolutely necessary, **use UAVs in natural disasters and more stable political contexts** and avoid conflict settings given the potential negative political/military associations of UAVs and the consequent assumptions that may be made regarding affiliations and agendas.
- Avoid recording information that if intercepted, would threaten the security of persons.

Legal considerations

The specificities of the numerous applicable local and international legislation and regulations are beyond the scope of this paper. Legal advice should always be sought from an organization's legal office. However, the following issues should be kept in mind when designing and implementing a geospatial technology project:

- The legal environment governing geospatial technologies is constantly evolving. The organization using UAV technologies should be aware of the applicable legislation and should design the project in such a way as to comply with such legislation.
- Any third-party service providers or contractors or implementing partners involved in the project should be required to comply with all applicable legislation.
- National legislation in certain jurisdictions may set a lower standard than best practice or ethical considerations would warrant. In such cases, implementing organizations and their partners should be guided by best practice or ethical considerations (as noted in this paper) and not just the minimum legal standards. (This may involve setting a higher standard for contractors than applicable by law).

⁷ Gilman, D., 'Unmanned Aerial Vehicles in Humanitarian Response', OCHA Policy and Study Series 10, June 2014.

- The following resources may provide some background information regarding legislation and registration of drones in various countries:
- Compendium of national regulations pertaining to drones:
<http://drones.newamerica.org/#regulations>
- The Centre for Spatial Law and Policy
<http://www.spatiallaw.com/>
- Global drone regulations databases
<https://www.droneregulations.info>
<https://drones-and-pilots.com/worldwide-drone-regulations/>
- Joint Authorities for Rulemaking on Unmanned Systems
<http://jarus-rpas.org>
- Global UTM Association
<https://gutma.org>
- Federal Aviation Administration (FAA) Drone Registry
http://federaldroneregistration.com/?gclid=EAlalQobChMliYSpzaOv1gIVCFqGCh3CFwluEAAAYASAAEgLKwPD_BwE

The above section outlined some ethical considerations when using geospatial technologies or data. The following section summarizes the guidance in a checklist of questions that need to be asked to support ethical evidence generation and to determine whether and/or what types of mitigation strategies may be required.

CHECKLIST FOR ETHICAL USE OF GEOSPATIAL TECHNOLOGIES FOR EVIDENCE GENERATION

The following are questions that need to be considered and reflected on in consultation with relevant stakeholders and experts to ensure that UNICEF is able to reap the benefits of these technologies while also protecting the children and communities that it serves.

| Tick = Yes Cross = No | Questions | Comments |
|--|---|----------|
| Identifying the benefits of using geospatial technologies for evidence generation | | |
| | Have you considered the nature of the data that could be collected or mapped via these technologies and the potential demand for and use of this data within the context of current strategic planning? | |
| | Can you clearly specify the benefits of using geospatial technologies for your particular purposes? Is this supported by the evidence (where available)? | |
| | Do you have staff with capabilities and expertise to responsibly lead and undertake the work and to develop, utilize, manage and analyse technologies and data in a timely and useful way? | |
| | Have you considered the availability and comparative utility of other data/information prior to collecting data via geospatial technologies or from third party providers? | |
| Ensuring privacy and security | | |
| | Have you reviewed data to ensure that individually identifiable information is removed or obscured? | |
| | Have you reflected on privacy and ensured the highest possible privacy conditions throughout each stage of the project? | |
| | Are you aware of the privacy policies of any organization whose data or platforms you are using? Including: | |
| | 1. Any anonymization or aggregation of data undertaken by the third party (preferred). | |
| | 2. The nature and security of storage. | |
| | 3. Whether provisions exist relating to individuals' ownership of data. In the absence of these, clear and public disclosure should be considered with regard to use of this data. | |
| | 1. Is the third party you are receiving data from domiciled in a country with broad surveillance powers? | |
| | 2. If yes, have you considered the risks and benefits to the populations involved? | |
| Understanding the data risks and limitations | | |
| | Have you discussed with data providers and data analysts the value and limitations of the data? | |

| Tick = Yes Cross = No | Questions | Comments |
|--|---|----------|
| | Have you signed an agreement/MoU with service providers or volunteer organizations clarifying clear data sharing and people identity protection clauses? | |
| | 1. Have you considered the potential for discrimination relating to individuals being geographically categorized? | |
| | 2. Have you considered the potential for discrimination resulting from any application of machine learning algorithms? | |
| Assessing other potential harms | | |
| | Have you made contingency plans in case: | |
| | 1. Access to technologies or infrastructure is blocked or breaks down unexpectedly, | |
| | 2. Data is wiped out remotely, or | |
| | 3. A privacy breach occurs. | |
| | Have you provided sufficient information or training for crowdmapping participants on potential risks and protection strategies? | |
| | Have you provided clear information to potential crowd-mappers as to what will or will not be undertaken consequent to findings provided by crowdmapping? | |
| Engaging communities | | |
| | Have you undertaken a consultative process involving all relevant stakeholders to produce a risk assessment framework? | |
| | If not, have you, at a minimum, informed (in the context of social media based programmes) relevant communities to let them know about the evidence generation programme? | |
| | Do you have a means by which community consent might be obtained from the target communities? | |
| | Do you have a means by which data can be shared with the target communities? | |
| Assessing risks and mitigation strategies for geospatial data capture from unmanned aerial vehicles | | |

| Tick = Yes Cross = No | Questions | Comments |
|--------------------------------|---|----------|
| | Are you intending to use a UAV in a conflict zone/fragile state? | |
| | If yes, what is the justification? | |
| | Is it absolutely essential? | |
| | What relevant authority units will be supporting teams on the ground? | |
| | Do the benefits outweigh the risks – have you made a determination based on a comprehensive assessment of security and safety issues and potential perceptions of the organization and its personnel if you send a UAV into this context? | |
| | Have you set up systems that avoid recording any information that would present a security threat to individuals and groups if intercepted? | |
| | Have you adopted approaches that minimize the resolution of visual data captured (including maximizing the distance between object and visual imaging technology) to ensure the lowest resolution while maintaining the value of the data captured? | |
| | Irrespective of context, have you planned to engage with the communities in the visible path of the UAV and/or to notify and/or discuss the launch of the UAV? | |
| | Are you intending to launch and land the UAV from the location to be surveyed? | |
| | If landing is to be remote at a different location, is there a plan for having a recovery team available at the remote site so that the UAV (and data collected) does not fall into the hands of wrong people? | |

CONCLUSION

Geospatial technologies have and will continue to provide vital geographical data to address key information gaps in development and humanitarian contexts. Further, they have the potential to do this at a massive scale, in real time, and at significantly lower costs (both in human and financial resource terms) than many other geographical data collection processes.

Both the potential advantages as well as the risks of using geospatial technologies should be recognized. A clear process of consideration, consultation and assessment prior to adoption or use is recommended. This needs to be undertaken prior to any dismissal of the opportunities presented and certainly prior to wholesale adoption. What is clearly required is thoughtful, strategic and carefully assessed use of these technologies both today and – as they and the landscapes in which they are adopted continue to evolve – into the future.

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