Digital mapping and inclusion in humanitarian response

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Acronyms

AI	artificial intelligence
CDC	United States Centre for Disease Control
ESRI	Environmental Systems Research Institute
FEWS-Net	Famine Early Warning System
GIS	geographical information system
HHI	Harvard Humanitarian Initiative
HOT	Humanitarian OpenStreetMap Team
IOM	International Organization for Migration
IPC	Integrated Phase Classification
ISCG	Inter Sector Coordination Group
LGBTQIA+	lesbian, gay, bisexual, transgender, intersex, queer and/or questioning, and asexual and/or ally
MSF	Médecins Sans Frontières
NGO	non-governmental organisation
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OSM	OpenStreetMap
UAV	unmanned aerial vehicle
USAID	United States Agency for International Development

Executive summary

Digital mapping is a critical activity in contemporary humanitarian responses. It is often the first step to improving situational awareness and coordination, facilitating access to affected populations and understanding pressing humanitarian needs. Through the collation and verification of geolocated data, the location and condition of key services can be monitored, the likely impact of hazards can be predicted, and reports of violence can aid the protection of those affected by conflict.

Though digital mapping tools and the global network of humanitarians who contribute to them are recent developments, issues of who is represented and who contributes to a shared understanding of a place or crisis are not new. Ensuring inclusivity – here referring to actions taken to ensure the right to assistance, information and protection for all people affected by crisis – is a challenge for the humanitarian system. The sector shares with the field of cartography a history of exclusivity that has led to extractive relationships with those they seek to assist and depict. Much of this has continued with digitalisation, usually to the detriment of the most marginalised people in crises. Yet participatory processes, open-source platforms and advocacy groups are also helping to break the exclusive dynamics in mapping, with much of this work made possible through new digital tools.

The impact that digital mapping has had on inclusivity in practice cannot be known for certain: as just one tool for understanding context and needs, it is applied within a far wider world of different priorities and incentives. But the value of visibility as the first step to greater inclusivity should not be underestimated. With millions of people simply invisible on many digital maps, recording their presence is often the first step towards improved public services and humanitarian responses, and greater accountability for those who provide them, as examples from informal settlements in Kenya, refugee camps in Uganda and urban Manila in the Philippines indicate.

However, humanitarian responders face difficult trade-offs with inclusion and mapping. Inequities in access to and use of digital technologies mean the most marginalised can remain so even when free-to-access online platforms invite affected people to submit reports to inform crisis maps. Remote map creation can present local realities to a wider audience, but can also facilitate a 'distancing' and a remote management of responses, which help to preserve exclusive dynamics. Though maps and the data collection processes they show can achieve more granularity and accuracy than ever before, to the benefit of service providers, the means by which those mapped can access their own data have not improved at the same pace. Mapping may not perhaps present as obvious a data management risk as other technologies, but geolocated data can easily be layered together to identify particular groups for the purposes of further exclusion and harm. The scale of digital mapping now means more people than ever are being represented, but such drawbacks mean this does not necessarily equal greater inclusion.

The growth of crowdsourcing, where volunteers build maps from satellite imaging and on-the-ground data, also presents both new opportunities and barriers for inclusivity in responses. On the one hand, the creation of such 'global public goods', through a network of volunteers, is a positive and necessary step towards an alternative, networked means of humanitarian responses, with benefits beyond the

strict scope of the aid system, its metrics and projects. On the other, such initiatives need to work deliberately to improve the diversity of their volunteer mapmakers, who are still dominated by those from Western Europe and North America. An approach based on volunteering also has limitations for ensuring maps remain updated as well as improving inclusion in low-income contexts. Open-source platforms come with their own risks, biases and potentially exclusive dynamics that also mean inclusive mapmaking is not guaranteed.

A key barrier in improving the inclusivity in digital mapping is that, like many technology-heavy approaches, it is often framed as a purely technical process that sits outside political and social dynamics. Technical accuracy can be easily conflated with objective 'truth', and mitigating against this requires constant engagement with affected people and those with a contextual understanding of the mapped crisis. This is demonstrated through the various mapping initiatives used in the Rohingya refugee camps of Cox's Bazar, Bangladesh. Though mapping delivered clarity and a basis for successful advocacy to improve services, early mapping was criticised as overly technical and lacking participation from camp residents. The case also showed the tensions between different ideas of the purpose of such mapping: either as a process to represent 'lived realities', or as a means to recognise and drive a more inclusive understanding and organising of communities in crisis. In a humanitarian context, with such a gulf in power between mappers and those mapped, it becomes all the more critical to understand people's perspectives and lived experiences through offering a means of participation in the codification of spaces and communities.

Some mapmakers have attempted to do this by decentring themselves and creating visualisations, labels and participatory processes more intuitive to affected people – the intended audience of such tools. Other initiatives include self-labelled 'messy maps' that sacrifice perceived objectivity to portray the less quantifiable experiences and networks of support in crisis important to the map's users. Such initiatives also help frame maps as an ever-changing, subjective tool, and only the beginning of a conversation. And though not being included is likely a more common concern among aid users than being included against their will, the right of individuals and communities to exclude themselves from any such representation should also be considered a key part of an inclusive mapping process. These ways to improve inclusion are, however, small in scale and limited by humanitarian programme cycles and funding.

In seeking to improve inclusion in digital mapmaking, humanitarian actors should be conscious of being only minor actors in a wider ecosystem. The proliferation of for-profit entities, community and volunteer networks and others makes coordinating and upholding any principles or core standards increasingly difficult. As this group of contributors and users of such tools gets larger, new ways to misuse the data of the world's most vulnerable people only grows. However, provided a more diverse set of perspectives are included in mapping, more potential uses and audiences for such tools come to light, as do articulations of new digital rights. These will be necessary to push back against default trends and instead drive an alternative and more inclusive digital future for those affected by and responding to humanitarian crises.

1   Introduction

Humanitarians understandably love maps. They are a common fixture on the walls of management offices of aid programmes, a centrepiece of many participatory exercises with affected people, and an accessible visual representation of complex data. Maps offer a basic geographical understanding of a place, and also increasingly detailed assessments of hazards, services and needs, and likely impacts of a disaster in advance. Maps implicitly communicate a contextual awareness while, at the same time, positioning the viewer far above any messy 'on the ground' realities. This is a useful combination for responders that still tend to see themselves as neutral and separate from such complexity.

Yet the functionality and apparent objectivity of these visualisations and tools hide many controversies, and these have relevance to debates around how the humanitarian sector operates more generally. As decolonisation advocates and critical cartographers have known for many years, maps are not neutral but a product of the priorities and incentives of their creators. Mapmaking, like much of the international humanitarian sector itself, has uninterrupted historical links to colonialism and this continues to influence many of the prevalent structures and attitudes of both enterprises today. Most obviously, the maps of many humanitarian contexts predate political decolonisation, and are only now being replaced by more contemporary representations, while many of the assumptions and power dynamics in the process of making maps are also still present.

The advent of geographical information systems (GIS)[1] and digital mapping has rapidly expanded the possibilities for a far greater and more up-to-date understanding of humanitarian contexts. It is also an activity that has been made more accessible and is no longer the sole responsibility of specialists. The past decade of mapping is not only a story of more sophisticated technological tools, but of different approaches and perspectives brought by this wider group of mappers, including 'digital humanitarians' and the global OpenStreetMap community.[2] Current practice now involves such a broad group of creators that, for the non-specialist, digital humanitarian mapping can appear as a confusing plethora of competing platforms and products for volunteers, for-profit entities, governments and aid projects.

As part of HPG's 2019–2022 Integrated Programme of research, this study uses the issue of inclusion in humanitarian action as a lens through which to look at the effects of digital mapping and its implications. Inclusion has been a key determinant of whether humanitarian responses are effective, and can be defined as 'actions taken to ensure the right to information, protection and assistance for all persons affected by crisis, irrespective of age, sexual and gender identity, disability status, nationality or ethnic, religious or social origin or identity' and to ensure 'equal rights and participation in humanitarian response' (Searle et al., 2016, in Barbelet and Wake, 2020: 9).

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1   GIS refers to digital tools to collect, store, edit, analyse, share and display location data that can then be mapped (Evans, 2021).

2   OpenStreetMap is a free to use and edit digital world map. The project began in 2004 in response to legal, financial and technical restrictions on the use of other mapping platforms, and continues to be built and updated largely by a global community of volunteers (OSM, 2021a).

This paper considers how technologies such as mapping have significant implications, both positive and negative, for inclusion in humanitarian responses. Sometimes they can be in tension with one another: for example, while remote digital mapping can represent and visualise more people, this greater scale raises questions around the consent and participation of those represented. Humanitarian responders with limited time and resources – such as those involved with the Rohingya response in Cox's Bazar, Bangladesh, which this study considers – may face difficult trade-offs for inclusion. Analysing digital mapping through this lens also highlights issues beyond the scope of what is often discussed in the aid sector around technology, such as responsible data management, and touches on wider societal questions around digital rights, the relationship between data extractors and data sources, and authorities and the governed (see Box 1).

While many of these issues are not new, the great diversity of actors now involved in digital mapping in crises, as well as new technological developments, make a focus on inclusion relevant and pressing. The growth of crowdsourcing, where volunteers can build maps from satellite imaging and on-the-ground data, has contributed to a shift away from maps being just a 'top-down' understanding of a place. Instead, contemporary mapping offers an alternative, more dynamic means of understanding the ways people respond to humanitarian crises, including crisis-affected people themselves contributing through digital tools in a process that can help inform humanitarian responders where needs are greatest, or at least loudest. The potential uses of such tools also now go beyond just humanitarian operations, including protection, advocacy and, increasingly, predicting where and how crises will occur. As this group of contributors and users of such tools gets larger and more diverse, new ways of furthering inclusion, as well as new means to misuse the data of the world's most vulnerable people, only grows.

Box 1   The focus of this study

Maps can be compelling visualisations but are the end product of a longer process of data collection. As such, a study of maps and their role in inclusion in humanitarian responses should consider not just this output but the whole process from its initial design and data collection through to its uses and effects. For example, drones or unmanned aerial vehicles (UAVs) are common tools for imaging areas ahead of mapping and carry with them their own set of practical and ethical implications as a technology. Maps could also be generated using geolocated data derived from smartphones or other sources, which may be useful in a crisis response but raise issues of privacy and data security.

Recent debates around digital technologies in the sector have especially highlighted tools seen as personally intrusive, such as biometric identification. In contrast, maps could be seen by non-experts as relatively benign and functional. Yet not only have the power imbalances of mapping been fiercely contested for decades, debates around how to use a relatively mature technology such as digital mapping in an effective, responsible and inclusive manner also have relevance for the role of technology in the humanitarian system as a whole. While technologies and their promises to understand and solve complex political, social, economic and environmental issues have always been a part of aid, the sector has taken a 'technocratic turn' in recent years, with great implications for how it operates and perceives needs and contexts. With a greater reliance on approaches such as digital mapping, it becomes even more pressing to better understand the dynamics at work when such tools are used.

Maps are created through various technologies and the pace of change and development presents difficulties for ensuring any study has lasting relevance. Every year, digital mapping becomes more automated, with images able to be ever more granular and closer to real-time. However, debates around mapping, such as the relationship between mapmakers and the mapped have endured for decades; changes to these dynamics have relevance for the wider sector and its means and will to respond in an inclusive manner. As a consequence, this study does not review in detail the specifics and evolution of different technologies and instead looks at how maps are developed and used in humanitarian responses, as well as their various social, political and ethical implications, and how they can be used to both reinforce and challenge power structures and perceptions.

2   Maps in humanitarian crises

In humanitarian crises, maps have always been created from an array of data sources to inform responses. They also reflect the particular ideas, priorities and assumptions of the aid sector. This has continued with digitalisation and the emergence of open-source mapping, where volunteers from across the world are changing the dynamics of a space once seen as specialist and inaccessible. This section provides an overview of how digital humanitarian mapping has developed, its current uses and key actors.

Creating spatial representations of reality is common across human societies and has proved to be a 'vital technology of political claim-making and contestation' (Bargues-Pedreny, 2019: 1). Mapmaking made possible the early modern maritime navigation, land seizure, resource extraction and military campaigns of European colonialism. Using maps for humanitarian, or at least public health, objectives also has a long history that predates the establishment of the formal international humanitarian sector. Maps of London tracking the spread of cholera by John Snow in 1854 and of poverty and relative deprivation by Charles Booth in 1889 are famous examples. Johns (2021) has also highlighted the earlier cartographic work of Valentine Seaman on the prevalence of yellow fever in New York in 1798 and its similarities to contemporary humanitarian mapmaking, including the merging of data sources and placing particular value on verified reporting.

Though aerial photography had informed mapmaking for decades prior, the advent of GIS analysis is commonly dated to the 1960s (NCAP, 2021). The discipline emerged as a framework to bring together and analyse data, with new photography and printing techniques allowing a layering of different representations and so a new means of analysis (Harder and Brown, 2021). As GIS grew more sophisticated, it was adopted by national governments and used in a variety of processes, such as land management, agriculture and urban planning. Dominated for decades by the Environmental Systems Research Institute (now known as ESRI), the advent of web-based GIS dramatically shifted the industry in the 2000s, most prominently with the launch of Google Maps and Google Earth in 2005.

'Participatory' maps in the aid sector – created with the contributions of residents, aid users or non-specialists – also have a long history that predates digitalisation. Mapmaking based on community dialogue, with the logic that everyone can see what is being 'said' because it is being 'shown' was a key element in what became the influential 'Rapid Rural Appraisal' approach to developmental needs assessments in the 1970s (Chambers, 1992: 20). But participatory maps have also been synonymous with activism: among the earliest 'recognisably participatory' initiatives were First Nations rights groups in Canada compiling crowdsourced maps to protect their land from developers and mining interests (Guldi, 2017: 80). With the rise of the 'GeoWeb' as a digital space in which information could be crowdsourced by volunteers, the participatory potential of such tools to challenge state and commercial interests increased. The launch of OpenStreetMap (OSM) in 2004, intended as a 'free editable map of the world' and inspired by the success of Wikipedia, provided a platform for users to contribute aerial photography, Global Positioning System (GPS) and other data.

The rise of digital humanitarianism and associated movements has been attributed to the emergence of 'web 2.0' in the mid-2000s, where there was an increase in public involvement in creating and sharing content, rather than just using the internet for information retrieval (Cinnamon, 2020: 123). Using open-sourced software, volunteer mappers can be based anywhere and the number of registered users on OSM has risen from 500,000 in 2011 to almost 8 million a decade later (OSM, 2021b). In humanitarian contexts, Chernobrov (2018: 6) proposes that these volunteers offer a 'unique combination of speed (providing verified updates that are closer to real-time than other sources) and safe distance (producing content that would otherwise be unavailable because of limited or unsafe access).' Affected communities are also volunteer mappers, adding their own contextual expertise to maps and using such tools to drive change and advocate for better recognition and services.

In 2008, the web platform Ushahidi (meaning 'testimony' in Swahili) was launched in response to post-election violence in Kenya. Crowdsourced reports of violence were submitted, initially through SMS, allowing maps to be created showing the distribution of reported instances. Ushahidi was later used in the 2010 Haiti earthquake, where volunteers generated more than 50,000 incident reports as victims shared urgent needs (Gazi and Gazis, 2020; Meier, 2015). The earthquake has been cited as pivotal in the birth of 'digital humanitarianism', as a global network of dispersed volunteers collaborated to map the crisis, using social media and other tools (Chernobrov, 2018). The Humanitarian OpenStreetMap Team (HOT) was incorporated after this response: now comprising more than 100,000 practitioners, it uses OSM to rapidly create maps to assist crisis response (Allan, 2020: 225).

The past decade has seen a proliferation of actors mapping in humanitarian contexts, with implications for inclusion. While more organisations provide more avenues and ways in which affected people can participate, it can also dilute standards and accountability in these processes. Alongside non-profit entities and volunteers are businesses, including satellite imaging companies, data analytics firms and the world's largest companies. Facebook, Apple, Amazon and Microsoft are all involved in the GIS space, including in partnerships with large humanitarian organisations and agencies. This includes involvement in open-source mapping initiatives alongside volunteers, where the role of the private sector is hotly debated. Initiatives to improve integration of data from all of these actors have also stepped up, however. 'Missing Maps', founded by the British and American Red Cross, Médecins Sans Frontières (MSF) and HOT and comprising 14 other organisations, is a prominent example of collaboration that also utilises volunteer mappers on OSM, especially in mapping areas with less interest from for-profit entities (see Figure 1). UN agencies such as the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) have similarly sought to integrate OSM data into crisis mapping, having done so for the first time in 2011 (Gutierrez, 2019: 113).

Figure 1   A mapper tags buildings and other features in Colombia, 2016
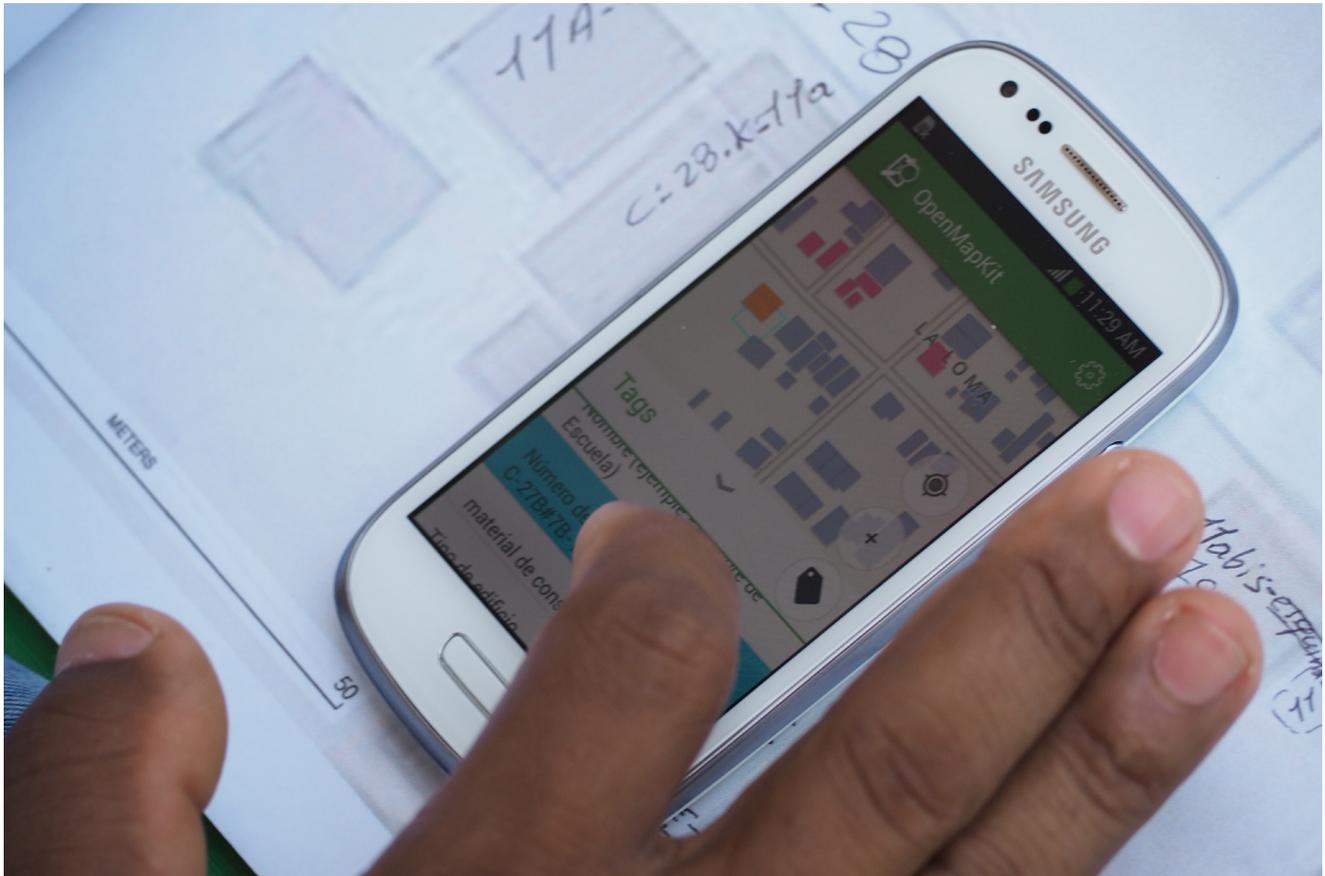
Credit: American Red Cross

2.1   What can maps be used for in humanitarian crises?

With digitalisation, mapping became both more readily accessible for non-specialists and also the face of a larger, dynamic information system, allowing both GIS and participatory mapping to shift increasingly toward offering customised maps for particular users (Specht, 2020: 3; Johns, 2021). The ease with which maps can now be configured in this way means their uses can include almost anything in a humanitarian context, including hazards and threats to humanitarian needs as well as the response itself. Gutierrez (2019: 113) proposes that it is now effectively 'impossible to respond to an emergency without a (crisis) map', and that they are 'one of the rare commonalities among all agencies attending any emergency'.

2.1.1   Understanding hazards, services and needs

Digital mapping by humanitarian organisations for operational uses is chiefly concerned with improving situational awareness. The road network, topography of the affected area and weather conditions constitute some of the basic information necessary for accessing affected populations, but following a crisis such data may be outdated as the landscape and conditions of infrastructure could be radically altered. Today, mapping in areas without up-to-date maps usually involves the use of satellite imagery or photographs taken from the air as its first stage. This is used as a base on which buildings, roads and other

useful elements can then be 'traced' by a human mapper or software that can distinguish surface features, creating the map. As will be discussed, this is often only the basic requirements behind a useful map, as greater detail requires another level of involvement by those with contextual knowledge of the area.

GIS now has the potential to far surpass simple geographic data for humanitarian access. Digital mapping can show the extent of a hazard after it has struck, such as earthquake or flood damage, but an even more valuable process is that of exposure mapping that can estimate the likely impact of hazards in advance. This usually involves the layering of complex datasets: data on drainage, ground surfaces and topography could predict flood impact, while precipitation, wind data, soil moisture, existing surface water and the shape and condition of buildings could suggest the likely impact of storms. This anticipatory element is not a new development: the Famine Early Warning System (FEWS-Net), founded by the United States Agency for International Development (USAID), has been in continuous operation since 1985 (Funk et al., 2019). But today, initiatives such as the Integrated Phase Classification (IPC) system add to what is now a complex predictive analysis network around food insecurity. Such tools use a wide range of data sources and are becoming connected to reactive initiatives, such as anticipatory financing mechanisms that automatically disburse emergency funds when certain thresholds suggesting imminent food insecurity are reached.

Mapping the built environment and affected people themselves is also now a key element of needs assessment and can also utilise predictive elements. Simple maps of displacement camps for aid planning can now be accompanied by maps showing evidence of displacement in conflict contexts, estimations of average refugee locations and their likely route, which can be used to predict the scale of arrivals (HHI, 2020; Giraudy, 2020). Mapping services, or a lack of them, can demonstrate distribution and likely needs when overlaid with population data, of which Facebook AI has recently made a near-global set of maps for free. In this way, maps promise increased coordination of responses and easier targeting to areas with most pressing needs.

The response to Covid-19 has also led to a renewed interest in mapping facilities and people, as governments and healthcare providers scramble to respond and prioritise care in a rapidly changing global crisis. GIS has had a key role in previous disease outbreak prevention and management, including the US Centre for Disease Control's (CDC) development of 'ArboNET' in response to West Nile virus in 2000, which collated data from local sources for a broader view of cases (Geraghty, 2020). Since then, GIS tools in outbreak analysis have grown more sophisticated, including in predicting likely outbreaks through spatial mapping of watercourses and sources of pollution. The accessibility of such tools has also increased, so that these GIS tools for analysis are now available to frontline local health workers responding to Covid-19, rather than just remote researchers (ibid.). This similarly applies to humanitarian contexts, and interviewees for this study are involved with mapping projects globally that include tagging medical and water and sanitation facilities, often in areas of informal settlements (see Figure 2). Others have cited mapping as a means to coordinate the delivery of food relief among private sector actors in the Philippines and areas of refugee settlement in Uganda during the Covid-19 pandemic.

Figure 2   Screenshot of a map created by Humanitarian OpenStreetMap Team Uganda showing the location and functionality of water points in the Rhino Camp refugee settlement
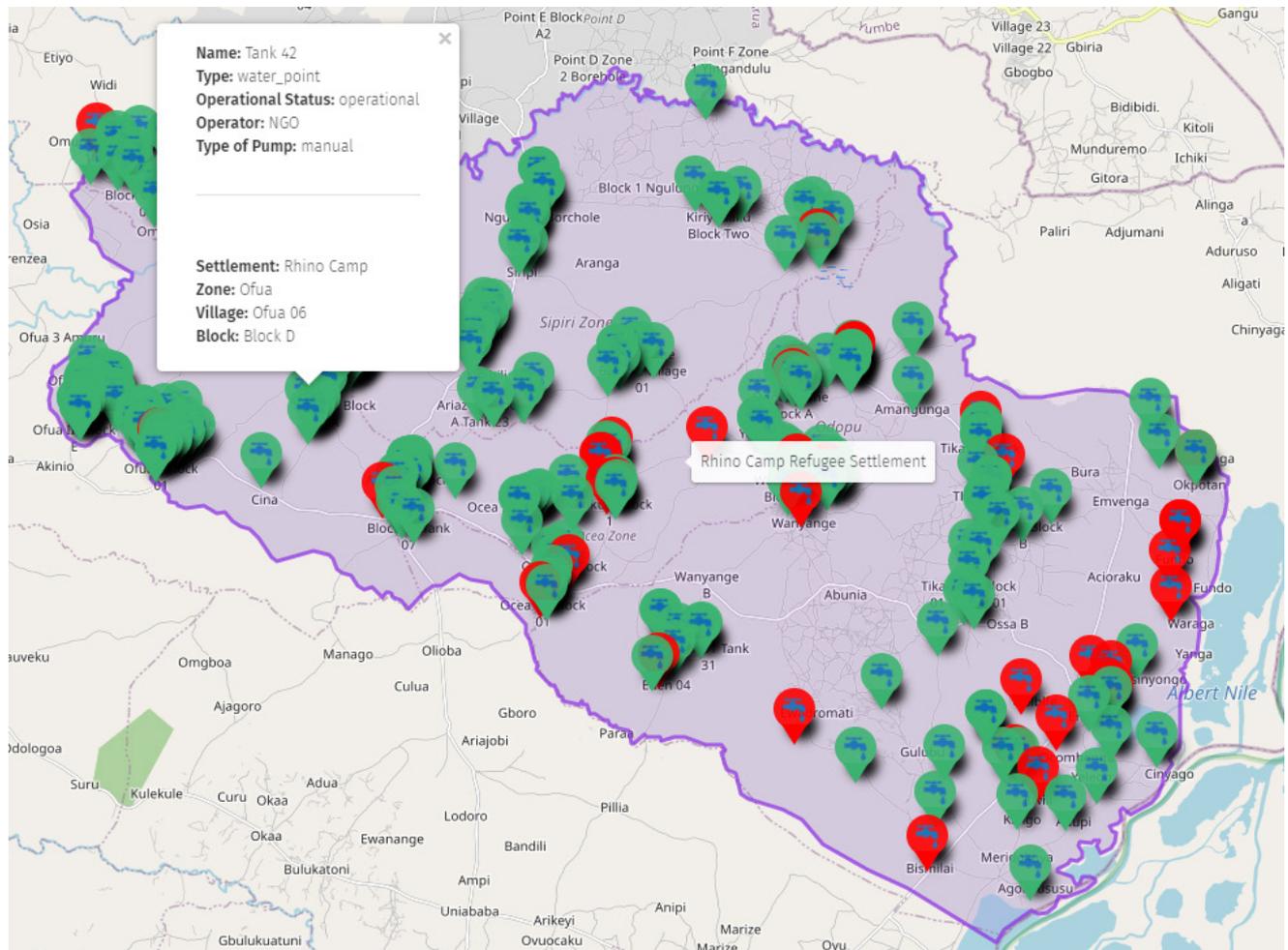
Source: http://umap.openstreetmap.fr/en/map/rhino-camp-water-points_204934#12/3.1100/31.3237

2.1.2   Advocacy and accountability

Mapping such facilities can be the first step in using these visualisations for other uses, such as to advocate for rights of aid users or hold authorities accountable. Various citizen-mapping initiatives often started with the explicit goals of correcting perceived government indifference or an inadequate response to a crisis (Asmolov, 2020: 49). Aid providers are also powerful actors in crisis contexts and the spread and quality of their services can be interrogated using mapping tools. In a crowded space with many service providers, such as a refugee camp, maps can act as a valuable coordination tool but also a means of accountability. This was one of several objectives of a mapping process carried out of camp facilities at Cox's Bazar, Bangladesh, by its relief coordination body (the Inter Sector Coordination Group (ISCG)) and REACH (a data analysis initiative comprised of the United Nations Satellite Centre (UNOSAT), Impact Initiatives and ACTED). GIS and physical tagging of water and sanitation facilities, including taps, was designed as a rapid means for staff to report faults – an important tool for accountability (Wencel et al., 2018). For example, though non-governmental organisations (NGOs)

would justify building more tube-wells to improve access in a particular area, staff explained 'tagging and mapping initiatives would reveal there were ten times the reported figure'. The number of wells was not the issue: gaps in service provision were caused instead by broken existing facilities caused by the perennial humanitarian issue of a lack of resourcing for adequate maintenance.

Though they are traditionally associated with states and top-down authority, maps can also be used as a tool by communities as a counter to such power. For example, they can be used to assert claims to land. In 2019, advocates from the Waorani communities of Ecuador used maps in this way in their successful campaign to question the validity of a consultation process that led to the mass sell-off of their land to oil companies (Ryan, 2019). In contexts where land ownership is unclear or informal, settlements may not be mapped at all, and their invisibility can compound their neglect by host governments. In such cases, mapping has been framed as advocacy, since the depiction of informal settlements on maps is presented as the first step in recognition, improved services and rights (Fisher et al., 2018: 48).

Among the most prominent example of such an approach is Map Kibera, which since 2009 has mapped the services and community living in Kenya's largest informal settlement. For its co-founder, however, Map Kibera did not 'intend to solve a specific accountability gap, but rather to shift the locale of information and follow the desires and needs of the community' (Hagen, 2017: 9). Rather than purposefully argue with politicians for the rights of its inhabitants using these maps, the initiative follows a philosophy of teaching residents how, not necessarily what, to map; using such tools to advocate for better services is one of many desirable benefits. Such an example also highlights the limits of advocacy in such a context: the 'particular powerlessness' associated with informal settlements means successful accountability initiatives require 'a highly nuanced understanding of land ownership and occupancy, social networks and systems of trust' (Hagen, 2017: 10). Using maps for such purposes puts issues of politics and power front and centre, and also highlights the limits of such tools and of processes that lack sufficient ownership and control by those mapped. As will be discussed, the process by which marginalised people can create and use maps to assert their rights or sovereignty is seen by many advocates as a crucial goal in using such tools for inclusion.

2.1.3   Protection

Maps have also been used as a means of displaying threats to the life and well-being of those in situations of conflict or violence in humanitarian contexts. Maps are used to highlight and investigate particular incidents or alleged crimes after an event and, increasingly, as a means to provide protection to affected people in a humanitarian context. While satellite imagery with mapping components to show evidence of atrocities has been admitted in international criminal tribunals for three decades, the latter use is a newer phenomenon.

Evidence of conflict and displacement was dramatically highlighted by the 'Satellite Sentinel' project in Darfur, Sudan in the 2000s, in which volunteers identified burned-out villages and military vehicles. More recently, mapping has also been used to highlight rights violations in cases such as the Rohingya refugee crisis, including the mapping of potential repatriation camps and villages in Rakhine state, as

well as 58 former settlements demolished in 2018 (Ruser et al., 2019). Many of these reporting and advocacy activities are not led not by states, but by citizen-led initiatives such as the open-source intelligence agency Bellingcat. In 2014, the group rose to prominence in its use of geodata to identify Russian weapons involved in the shooting down of a commercial airliner over Ukraine and, later, evidence of atrocities carried out by government forces in Syria (Higgins, 2021). Other open-source analysis and advocacy groups, including Forensic Architecture and Syrian Archive, also use geospatial data to document and campaign rights violations, including in humanitarian contexts.

Maps used for the protection of affected people in crisis rose to prominence with initiatives such as Ushahidi, an early example of a tool with the aim of providing both advocacy and immediate benefit to affected people caught up in violence. Later examples include the 'SafePath' social media groups in Libya, which directed users to avoid certain roads during fighting (Ceasefire and Minority Rights Group International, 2019: 4). Such tools are made possible by recent technological developments, benefitting from both higher degrees of accuracy in their geolocated data and, crucially, an immediacy of 'near-real time' data collection and publication (Gutierrez, 2019: 109).

The limits of mapping and imagery for protection purposes are similar to humanitarian mapping as a whole. In general, remote sensing lacks a consistent approach by which investigators can analyse evidence, or 'criminalistics', though guides do exist (HHI, 2020; Raymond et al., 2014: 35). Such imagery can also show the impact of only a small proportion of possible rights violations, such as large-scale conflicts and the wholesale destruction of settlements (Wang et al., 2013: 6). Taken together with more recent concerns over the ease with which satellite images can be doctored, experts tend to argue that corroboration of the existence of atrocities is still needed by on the ground sources, otherwise any 'ambient protective effect' provided by such tools is likely to be minimal (Lichtman and Nair, 2015: 934; Raymond, 2017).

2.2   The challenges of measuring impact

Despite the wide range of uses and actors involved in digital mapping, it is difficult to assess its concrete impacts on humanitarian responses. While a finer-grained, more up-to-date and wider understanding of hazards and facilities has the potential to improve humanitarian decision-making, directly attributing better responses to such tools is not possible. However, though the confines of humanitarian project cycles make it difficult to attribute particular outcomes to particular technologies, many mapping initiatives have a far wider scope and, therefore, so should understanding 'impact'.

This was confirmed by interviewees, who could readily describe the many uses and potential of digital mapping to better understand contexts, but acknowledged the difficulty of measuring whether specific technologies necessarily led to improved responses. Mappers and GIS specialists attached to implementing organisations and agencies could more readily demonstrate direct links between mapping and its influence on project design, but the trade-off with more participatory methods tends to be that data is not necessarily made publicly available or shared between response organisations. For those initiatives that aim to develop open-source resources, organisations tend to be well aware of this potential disconnect, with one interviewee explaining how the 'Missing Maps' initiative was purposefully

'staying away from the rhetoric of "maps save lives"'. Instead, their benefits are framed in terms of aiding humanitarians by providing a better understanding of a humanitarian context, shortening the period of time needed for programme design, and so 'optimising the chance to have an impact'.

This qualified framing around impact is partly a consequence of a lack of connection between digital mapping and wider humanitarian programming. Interviewees described the frequent process of an issue being diagnosed and data collected, with a map becoming the end product rather than 'the beginning of a conversation', and admitted that this was still too common (Asmolov, 2020). Indeed, mapping as an output in response to a crisis such as the Covid-19 pandemic was reported by several interviewees, who had received funding to map health facilities and other services. Such information would be extremely useful to responders, but the lack of resourcing dedicated to assessing whether they would be aware of and use such resources makes confident assertions as to impact difficult. This appears common to both small-scale, participatory initiatives and large-scale, humanitarian-specific mapping. An independent review of the work of UNOSAT, for example, highlighted that, although its likely impact is high, 'its tangible effects in the field are blurred due to the lack of capturing [of] impact data' (Engelhardt, 2018: xiv).

Such discussions link to wider questions around the use of evidence in humanitarian decision-making, and how project cycles and funding limit flexibility to respond to changes in identified needs during a crisis. Rather than having an operational impact, some interviewees described humanitarian organisations' rush for interactive visual tools like maps and dashboards as intended instead for a donor audience. The intention of having digital maps is to communicate impact already delivered, competence, innovation and a framing of quantifiable needs being met, for further 'impact' of fundraising and visibility (Madianou, 2021: 862).

Yet it is important to recognise that, although the term 'humanitarian' is used in, for example, the Humanitarian OpenStreetMap Team and the wider 'digital humanitarian' movement, many involved in digital map creation tend to have a wider focus than the narrow silos of the formal aid sector and its drive to quantify impact. While reactive mapping of the kind used in the Haiti earthquake fits a narrow conceptualisation of humanitarian response, mappers are also motivated by a variety of developmental and activist goals, as well as the idea of building a 'global public good' of a representative, open-access map that anybody can use. Hagen (2019: 8) details how mapping can also benefit the relationship between a government and its citizens and improve data access and understanding of rights among both. The case of Map Kibera brought positive results with regard to both practical impacts, such as contributing to greater security, and unquantifiable benefits, such as improved technical skills and more pride in communities (Hagen, 2017: 31). One interviewee leading participatory mapping projects in East Africa alluded to this wider role: 'if we're not the implementers, we can't see the impact sometimes but what we can often see are the secondary impacts of others coming to us, engaging and asking for more data, and using it for their own ideas and purposes'.

Digital mapping can now offer an array of purposes and new ways to collate, analyse and present complex data. This in turn can assist humanitarian programmes in their speed and delivery, and later examples in this paper demonstrate they can perform a valuable function for coordination and delivery

purposes. Yet the often unclear connection this technology can have with programme impact was understood by several interviewees, and has been attributed to the scope of many mapping initiatives being beyond that of humanitarian programme cycles. But while the effects of digital mapping on programme delivery can be ambiguous, its impact on issues of inclusive responses in the sector is clearer, as such technologies change dynamics around both the visibility and rights of affected people and the approaches of humanitarian organisations to identify and meet needs.

3   Inclusion and humanitarian mapping

'Inclusion' has been defined as 'actions taken to ensure the right to information, protection and assistance for all persons affected by crisis, irrespective of age, sexual and gender identity, disability status, nationality or ethnic, religious or social origin or identity' and to ensure 'equal rights and participation in humanitarian response' (Searle et al., 2016, in Barbelet and Wake, 2020: 9). With this definition, digital mapping has great relevance for inclusive humanitarian responses: as a process of needs assessment and situational awareness, mapping can either help better include or exclude populations from protection or assistance. Mapping today also utilises digital technologies that are often unequally accessible across different groups of people, also risking exclusion. This chapter considers how these dynamics affect inclusion in humanitarian responses, proposing that, while digital approaches mean more data about affected people is collected and used, a lack of participation means such tools do not necessarily equate to improved inclusion.

3.1   Visibility as inclusion

An obvious benefit of digital mapping in crisis is its use as a means to identify affected people. An updated map based on recent imagery could show evidence of people not reflected in older or 'official' visualisations, especially critical in fast-moving humanitarian responses. This visibility is also relevant to inclusion, as the reasons behind previous 'invisibility' are likely a consequence of some form of marginalisation. For example, informal settlements that house displaced or marginalised groups may be recent developments and not reflected in outdated maps. However, invisibility may also be a deliberate choice for authorities who do not wish to acknowledge the existence of such areas. In addition, for-profit entities may not have a commercial interest in mapping such areas in detail. In making these areas visible and presenting current realities as depicted by the latest imagery, digital mapping provides a foundation for initiatives to improve services, infrastructure, hazard mitigation or some other form of inclusion. This logic is the key argument for dedicated humanitarian mapping, from overarching global programmes like Missing Maps to specific initiatives such as Dar Ramani Huria, a community-mapping project of informal settlements in Dar es Salaam, Tanzania for the purposes of flood preparation (Fisher et al., 2018: 48). Such initiatives may claim to have a positive influence on inclusion of these marginalised communities through providing greater visibility.

In humanitarian contexts, the audience for this increased visibility includes aid organisations. Allan (2020: 226) describes how, in mapping in West Nile, Uganda, residents were surprised at the presence of the team's field surveyors: a fragmented humanitarian response had meant NGO staff had missed entire communities based on plots further away from major supply roads, though still inside major refugee settlements. Updated maps with on-the-ground verification made these groups visible and so better included in aid provision, while informal settlements became better recognised by the host government.

The value of visibility was articulated by an interviewee who chaired an LGBTQIA+ mapping organisation in the Philippines. Comparing the organisation's mapping of safe spaces and health facilities to that of

mapping places of worship, they acknowledged that any 'geographic information can be used to do harm' by those seeking to identify and hurt particular groups. But, the mapper argued, the power of visibility was worth this risk. Highlighting the ease with which such facilities can be found, the mapper explained how the high frequency of friendly spaces demonstrates to all users the existence of the LGBTQIA+ community and 'normalises' their presence in wider society. This benefit mirrors similar findings of perception surveys in crisis contexts whereby users tend to be more concerned with the fear of being rendered invisible, and so left behind or missed by service provision, than by any perceived 'over-exposure' (Weitzberg et al., 2021: 3). Mappers based in humanitarian contexts tended to agree with this assertion, citing their areas of work with long-term displaced people as being 'centred around lists, centred around visibility … you receive services and assistance if you're visible', leading affected people to be generally in favour of greater recognition and visibility.

However, visibility may not always be beneficial, and invisibility is often a viable protection strategy. One mapper in the Philippines described the risk in mapping rural indigenous communities, explaining that, 'we are working with invisible communities … many organisations choose not to expose themselves because of the security situation'. Since military operations are used as cover for illegal land seizure or resource extraction, publicly available maps would risk facilitating this process. Rather than complete public visibility, maps are instead produced for a specific audience or advocacy goal, with any published data having labels and sensitive areas removed. In considering the balance between the benefits of visibility and any risk of 'forced inclusion', context is clearly key, and a higher degree of contextual awareness from mappers of particular dynamics in humanitarian contexts would inform the most appropriate strategies.

3.2   Accessibility, extraction and distancing

Digital divides are present in humanitarian mapmaking.[3] For example, a key barrier to access for local mapping initiatives and aid users is proprietary, or licensed, paid-for specialist software. Platforms of this type, often used by large UN agencies or international NGOs, are prohibitively expensive for many mappers. While offering specialist functions, such technology is restricted to GIS specialists working for these organisations. Unrestricted access to the data that such specialists create is also far from guaranteed (Allan, 2020: 221). Besides its cost, mappers also describe a high technical skill required to use such software, with 'less of a focus on design, far more on technical solutions that do not have accessibility as a main consideration.'

The issue of digital divides in crowdsourcing initiatives, where affected people add their location and needs on a crisis map, has also been highlighted. The 2015 Nepal earthquake response included a crowdsourced 'QuakeMap' that, although highlighting areas of need, received a disproportionate amount of reports from the Kathmandu valley area where connectivity, education levels and political

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3   The term 'digital divide' refers to the idea that access to and effective use of technologies is unequal, and that this inequity falls across lines of wealth or identity. This is an important element of inclusion, since a lack of means of accessing data or their end products can reinforce existing dynamics that lead to exclusion.

connections are all higher than in the rest of the country (Mulder et al., 2016: 9). Mappers working in contexts with low internet connectivity also cite instances of drones producing such high resolution images for mapping that they are often too large to process quickly (Cook and Picucci, 2017: 2). There are also discrepancies between data collection tools (of which many now exist that can work offline and so are more accessible) and collation tools that 'can transform that data into locally empowered data management', but which have far higher technical bars to entry and so exacerbate extractive dynamics (Jacobi, 2020).

Equal access to the technologies and software that facilitate mapping is essential for inclusivity. When aid users are unable to see their own data or use it for advocacy, they are denied the 'right to information' that constitutes an inclusive response. This 'extractivism' is at the heart of any colonial relationship (Madianou, 2019) and is a key concern for mapping, creating an artificial divide between those who supply information 'and the humanitarians from the West who acted on the information' (Crawford and Finn, 2014: 494). As has also been highlighted, this process may be part of a 'recognized trend to continuously collect data without always having ... clear links between analysis and response in place' (IOM, 2019: 6).

New modes of mapmaking such as open-source platforms can often increase accessibility and help challenge dominant narratives. Conversely, such technologies can also exacerbate 'distancing', where remote staff or volunteers can create maps using satellite imagery without the need for contextual knowledge or an on-the-ground presence, which could facilitate a more distant model of crisis response. For international humanitarian responders, digital tools can enable an increasingly 'virtual presence' in crises contexts, making their role 'physically remote and insulated from the societies in which they work' (Duffield, 2013: 11).

Interviewees involved in mapping processes understood the logic behind this notion that maps may facilitate 'distancing', and the risks of remote management in preserving exclusive dynamics. But many also saw an opportunity to present local realities more accurately to a wider audience, including humanitarians. The distancing effect was more prominent on issues of accountability, where greater distance between those who generate data and those acting on it risks 'separating a person from the consequences of their actions' (Madianou, 2021: 859). This is compounded by a multiplicity of actors involved in data collection and analysis, which in turn risks an uncritical interpretation of maps and other tools by needs assessors or service providers, without knowledge of methodological limitations.

Ultimately a degree of distancing is present in all projects using digital technologies, but this can be mitigated by mappers and validators with on-the-ground contextual expertise. So-called 'remote' initiatives have always relied on these experts: though the Haiti response has been framed as the beginning of 'digital humanitarianism', the 'basis for the success' of the project was those with contextual knowledge, as members of the Haitian diaspora plotted and translated incoming information to make a useable map for relief providers and affected people (Gutierrez, 2019: 102). Initiatives such as the Flying Labs Network, founded by WeRobotics, seek to counter the effects of distancing by advocating for a 'technology transfer' approach to affected communities. Created in response to a disaster-mapping

industry dominated by companies and non-profits based in the North America and Europe, the network seeks to mitigate the power imbalance of such projects in humanitarian crises through supporting locally led drone mapping organisations and principles to 'hire local' pilots and mappers.

3.3   Data responsibility and mapping

Inclusive responses should at a minimum protect affected people from existing harms. Using digital tools for mapping, which are part of a longer process of data collection on potentially vulnerable people, can create new risks. While wider concerns around the uses of personal data and how it may compromise privacy dominate much of the discussion around big data, information could be used for exclusion or harm at the community level. Raymond (2017) highlights the inadequacy of conceiving risks around this 'demographically identifiable information' through the prism of personally identifiable information and sees change in practices as unlikely until a so-called 'digital Goma'[4] moment of grave harm.

While data collection can present risks in humanitarian contexts, staff involved in digital mapping were specifically concerned about the potential harm of using demographically identifiable information. Much of the analytical power of digital mapping lies in the layering of datasets, perhaps to highlight particular hazards or needs. While individual datasets may not contain sensitive information, cross-referencing it with another non-sensitive dataset could reveal particular groups and facilitate persecution. For example, transaction data showing when and where cash was withdrawn using debit cards common to refugee assistance schemes could be combined with the locations of mosques, identifying people near them at prayer times (Capotosto, 2021). This is known as 'mosaicking' and was described as a 'huge concern' by one UN interviewee worried about targeting at the level of a group or community. Such a risk is compounded by a more networked model of conducting humanitarian work, of which mapmaking can be a key part. Data from many actors could be submitted to open-source mapping platforms, and used to create a crowdsourced assessment of needs and responses. Yet the risks of entirely open access and use of data have not been sufficiently faced in the sector, and safeguards are inadequate (Corboin et al., 2018: 30).

There are other risks from using open-source mapping in humanitarian settings, such as facilitating other activities from parties without humanitarian activities in mind. Municipal authorities in Nairobi, for example, did not require personally identifiable data of residents to use OSM data to clear informal settlements for road-widening projects. Neither did the government of Jordan, which, according to one interviewee, forcibly evicted residents from an informal settlement shortly after receiving geotagged data on it from a UN donor. One practitioner described their concerns around these unintended consequences as their projects making potential 'treasure maps' for hostile actors. Such concerns have

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4   Following the Rwandan genocide in 1994, more than half a million refugees fled to the city of Goma in neighbouring Zaire, now the Democratic Republic of Congo. Surrounding refugee camps saw an extraordinarily high death rate from disease and violence, but the humanitarian response itself became infamous for a lack of coordination and an 'aid-only' approach that was perceived as complicit in sustaining the genocide's perpetrators. An influential paper by Rakiya Omaar and Alex de Waal labelled the Goma response as 'among the most flagrant abuses of international relief in modern times' (Parker, 2019).

become more prominent since the announcement of the partnering of the World Food Programme and Mercy Corps with data analytics firm Palantir, known for working with controversial military and for-profit actors. Later assurances from those groups that Palantir would not have access to any personally identifiable information does not, however, mitigate the risk of non-personal geographic information being used for these kinds of harmful activities (TNH, 2018). While much of the debate around digital risks is more concrete for issues affecting personal data, it is clear that harm and exclusion can be done through non-personal data; such risks are likely to increase as analytics become more sophisticated and a central part of responses.

Inclusion in humanitarian crises could be interpreted in contrasting terms: as representing and so reaching as many people as possible, or a concerted effort to improve the participation of those most marginalised. With limited resources, humanitarian responders and mappers alike often have to choose. On the one hand, digital mapping certainly contributes to a wider process of providing protection and assistance to a greater number of people. The contribution of non-profit entities to ensuring geolocation data exists on marginalised people and communities is invaluable, and this visibility is a necessary step to improve services and accountability. Yet if 'inclusion' includes affected people having the right to information and to contribute to responses actively, trends in digital mapping do not necessarily point to greater inclusivity, although many participatory schemes are notable exceptions.

While mapping initiatives that make participation a priority are extremely valuable, they are also time- and resource-intensive: a key limiting factor in a humanitarian crisis and the main reason they are still relatively uncommon. As one humanitarian mapmaker proposed, a key question is 'how much we can prioritise such design for the most vulnerable with limited resources' – a fundamental issue in considering inclusivity, and one the sector does not yet have a clear answer on. Including the most marginalised people in mapping responses also forces mappers to confront familiar 'digital divides' in accessing mapping technology and data, and also consider the drawbacks of open-source initiatives that may require active management to ensure the rights of those mapped are protected. The risks that blanket visibility and open data present can also be barriers in upholding the rights of affected people to information and protection.

4   Inclusion and mapmakers

The field of critical cartography has long emphasised the importance of understanding mapmakers. Their 'positionality', informed by particular experiences, perspectives and values, is among the most important factors in considering the effect digital mapmaking has had on inclusion and humanitarian responses. Despite many efforts around consultation with and validation from those being mapped, the designers of mapping exercises ultimately frame and decide what to portray or prioritise in a visualisation that cannot depict everything. As critical cartography has long emphasised, those that make maps 'offer an expression of what they consider important' (Mogel and Bhagat, 2008). As maps are 'sites of knowledge production, representation and interpretation', the process of mapmaking requires a better understanding of which individuals and organisations are conducting such a process, in order to help consider 'whose reality' is being depicted and acted on (Crampton, 2010: 105).

Who is mapmaking matters because open-source mapping and other initiatives have the potential to bring aid users and affected people into the process of assessment, leading to a more inclusive response. This chapter considers these issues and draws upon recent debates within the humanitarian and mapping industries around representation and colonial legacies. It proposes that a technical framing of many mapping processes constitutes a barrier to greater inclusion, that open-source platforms have tensions between remote and community mappers that can influence inclusion, and that artificial intelligence (AI) offers a new set of challenges and opportunities for more inclusive mapping.

4.1   Diversity in mapping

The limitations of a lack of representation in the digital mapping community have been recently highlighted. Activities such as tagging features and editing remain overwhelmingly dominated by men, with a recent study suggesting 87% of OSM contributors identify as such (Gardner et al., 2020). The effect of this gender bias has been highlighted by Stephens (2013), who contrasts the array of categories available to distinguish different varieties of bar, or sexual entertainment services, compared with a lack of basic categorisation options for childcare provision. A recent study also observed subtle differences in activity on mapping platforms, with women contributors focusing more on the creation of new data, meaning that, unlike their male counterparts, they find more gaps in the information depicted in maps (Gardner et al., 2020: 1617). This demonstrates the necessity and value of a diverse group of mappers in accurately representing reality.

To address this gap, dedicated mapping groups for women have been founded in recent years, for example 'Geochichas', whose maps have been used to successfully lobby local government to advocate for improved protection services and expanding safe spaces in cities in Latin America. Despite these positive developments, such groups and advocacy still need to contend with group boards and mailing lists described as being blighted by 'toxic' gatekeepers, who often legitimise the male-dominated status quo of the industry through references to their technical expertise. The participatory mapping community, as several interviewees strongly asserted, is not yet an inclusive space.

Gender bias is not the only imbalance in mapmaking: digital voices, even in open-source settings, remain dominated by white men based in North America and Europe, including for humanitarian responses (Cooper, 2015). Though one interviewee described how the 'humanitarian' label tends to bring with it a more diverse and far wider audience of remote mappers than 'regular' maps in OSM, similar dynamics were observed. In humanitarian contexts, an additional problematic dynamic is between mappers who map their own communities and those from outside the context.

The lack of recognition of mappers with contextual experience is seen as a key issue for both open-source and proprietary software mapping. As one mapper working in East Africa explained, 'international mappers may be the experts on the remote elements but the community know their area and know best'. Yet community or even nationally based mappers are heavily outnumbered by those from Western Europe and North America who may lack the contextual expertise that can ensure these visualisations accurately represent reality for those on the ground. This tension of open-source mapping initiatives – that their strength lies in mobilising a broad network of people remotely as volunteers, regardless of location, while being at odds with the purposeful and specialist context knowledge needed for a representative map – is recognised by those who lead such projects. Yet resolving such a challenge through more investment in community engagement is hampered, as will be discussed in Chapter 6, by both current means of funding that can limit open-ended engagement and the proliferation of actors, which can undercut efforts to follow common practices regarding inclusion.

A constant across much of the issues around representation, and in both open-source and proprietary mapping, is that the framing of digital mapping as a 'technical' process can itself be a justification for the status quo and a barrier to greater inclusion. This is perceived in both observations of male dominance in volunteering – framed increasingly as 'technical' or 'expertise-driven' (Gardner et al., 2020: 1607) – and also the exclusive specialist spaces of hazard and needs assessments carried out by humanitarian agencies. One interviewee described a double barrier of technical skills needed to contribute and a wider culture of purposefully 'apolitical' discussions that revert to technical documents in limited languages with arbitrary mapping conventions that are not readily interrogated. Both hamper inclusivity. The implications of such barriers is that the field remains a one-way process of data extraction and the conscious effort needed to improve inclusivity is not as strongly advocated for.

4.2   Diverse organisations and approaches

Mapmaking, especially of marginalised groups, has been criticised for decades for implicitly reinforcing an exclusive, top-down means of understanding contexts and people, and in so doing reinforcing hegemonic Western knowledge and dominance. While digital technologies have the potential to facilitate 'two-way communication between agencies and affected people' and so 'reverse top-down structures in humanitarianism and its system of neo-colonial governance', current practice suggests an equal likelihood of one-way processes of data extraction (Ong and Combinido, 2018: 89; Madianou, 2021: 861). This section considers the way in which organisations approach mapping, and whether methods using open-source platforms are necessarily more inclusive.

Open-source mapping has the appearance of a 'networked' approach to working, with a diffused group of crowd-mappers contributing to a shared understanding of a context. The ubiquity of platforms like OSM has meant not one organisation has sole control on the flow and validation of geolocated data. To add to a sense of a new and 'networked' way of processing information, open-source initiatives purposefully frame themselves not as organisations but as movements, suggesting a more open and democratic system that provides an easier means for anybody to map, including crisis-affected people and non-specialists (Radford, 2020). These factors have the potential to enable a more inclusive means of data gathering and analysis that was recognised by interviewees.

Whether this model leads necessarily to greater inclusivity, however, is ambiguous. While 'movements' suggests inclusivity, they may also come with looser standards, which has implications for protection. Fundamentally, some argue that the inclusivity of an imperfect crowd of mappers is preferable to the alternative, that 'better a billion users and operators than Google or Facebook's reality' (Allan, 2020). Others question whether mapping organisations actually function as genuine networks or are especially different to humanitarian organisations. HOT, for example, is transitioning to a new model of independent regional hubs that is intended to bring the organisation closer to communities and also to provide capacity to local societies, in a similar fashion to a federated NGO. By 2018, an early founder of Ushahidi described it as having 'stopped being a citizen's initiative to become a company a long time ago', with it now covering both disaster response and activist mapping in a 'double nature' that has been compared to the transition of Oxfam into an organisation that 'supports hybrid aims' (Gutierrez, 2018: 111–116). Such shifts may suggest that, rather than an entirely networked model, prioritising inclusivity also requires institutionalisation and hierarchies that can facilitate a deliberate engagement with those least represented (Currion, 2018: 16).

Several interviewees felt there were tensions around the implications of a model that emphasises volunteering. Mappers leading community-level initiatives described how a lack of funding for paying local mappers is a barrier to inclusion, since 'unlike Western contexts many in developing countries don't have a lot of time or money to do mapping for free'. This is consistent with previous reports on including affected communities in mapping, where 'the idea of volunteering in the sense of working for free is not valued or desirable in a context of very low income', with potential mappers wary 'when learning big international companies are in a good position to make profit from their contributions' (Hagen, 2019: 19). This tension and what it means for inclusion has also been observed by advocates for aid sector reform, who have proposed that 'volunteerism being seen as the highest form of humanitarianism is a dated and elitist fallacy' (Krishnan, 2020). Rather than being accessible to all, a volunteering-heavy model limits inclusion of the least represented in many humanitarian settings, with greater involvement dependent on investing and paying for it.

4.3   Artificial intelligence and inclusion

The pace of AI or machine learning in the field of GIS has continued to accelerate, with implications for both humanitarian mapping and inclusive responses. AI was previously limited by requiring expensive, high-resolution imagery in order to recognise shapes it could identify as buildings, roads and other

features. Humans remained a necessity in validating any AI-generated maps. In recent years however, initiatives led by the United Nations Children's Fund (UNICEF) and the private sector have meant more accessible, lower-resolution imagery could be used, with AI identifying features with a high degree of accuracy. Such developments in the sector, along with the continued work of UNOSAT and the UN initiative Global Pulse, have been described as a 'gold rush' for automated humanitarian mapping that promises a transformative means of mapmaking in a crisis context (Wencel, 2018). Even the limits of the overhead view of satellite imagery are being overcome, with software now recognising features such as drains and water points in videos recorded by mappers on the ground in informal settlements (Ajayakumar et al., 2021).

AI in mapping, as in wider data collection and analysis, has attracted inclusion-related concerns. Much of the critical reaction to AI rests on its frequent presentation by developers and wider media as a purely technical, apolitical and authoritative tool. However, as Joy Buolamwini of the 'Algorithmic Justice League' and other scientists and advocates have highlighted, AI is effectively 'taught' using often unrepresentative datasets that can translate systemic bias into algorithms, replicating and reinforcing discriminatory practices while presenting a guise of neutrality. Rather than being a new means of processing and analysing data, it is merely a 'reflection of how well we are implementing our own ethical principles of transparency, justice, do no harm, responsibility and privacy' (Iacucci, 2019). Examples that pertain to mapping include software aiming to assess cyclone damage to buildings, which 'had a significantly lower accuracy when applied to images of a different geographical region' from where it was designed (Deparday, 2018: 23). Away from direct image recognition, AI has also been developed for use in, for example, the mapping platform Ushahidi, which is looking to automate data gathering through chatbots, where crowd-mappers submitting incident reports answer a series of questions to help better categorise and validate their reports (Gazi and Gazis, 2020: 41). Chatbots are also controversial with regards to inclusion. Despite saving time, they have been criticised for 'reducing participation to a box-ticking exercise' and extracting value, 'reproducing asymmetries between humanitarian organisations and affected people' (Madianou, 2021).

While recognising the risks of inappropriate tools, several managers of mapping projects take a pragmatic approach, and see AI as a means of improving efficiency because it frees up mappers for more valuable work, including creating more inclusive resources. The manager of an LGBTQIA+ mappers group explained that 'mapping buildings and roads are a necessary element of what we do, but it's ultimately unfulfilling … if AI was to apply all of that foundational work, maybe we'll actually have the space to map our own communities'. The group would have more opportunities to input their contextual knowledge, helping to drive interest and apply a more inclusive lens to the map. Another mapper reflected that 'AI has a bad reputation in the participatory mapping community', partly as a consequence of a 2013 incident of Facebook uploading a road map of Thailand that had used AI onto OSM, overwriting previous work with inaccurate categorisation and positioning. In contrast, Facebook's latest publicly available tool – high-resolution maps of most of the worlds countries that accurately predict population distribution based on building footprints and other features – is seen as being highly useful for identifying previously less-visible populations (Bonafilia et al., 2019).

While the view that 'opposition to AI tends to come from wealthy countries and support tends to come from poorer contexts' is oversimplistic, these practical considerations of the benefits of AI in freeing up valuable time and effort should be especially considered in the context of humanitarian mapmaking (Mustard, 2020). While AI can offer benefits for mapmakers, those using such tools are often distinct from those being mapped, and such conversations risk being consistent with 'the key disconnect between the focus of AI research, primarily on providing accurate information to decision makers, and the lack of time devoted to focusing on serving data subjects' (Kalluri, 2020). AI can make mapmaking easier for humanitarian mappers, but skills gaps were identified by interviewees across the sector, especially pertaining to understanding methodologies and algorithms that underpin much of this technology. Efforts to turn AI into a more inclusive tool, applicable to different contexts, depend on the ability of humanitarian actors and others familiar with debates around inclusion to engage with these issues. This is made more difficult by the increasing use of proprietary systems and software from third parties, and the sheer number of actors working in the response and digital space.

5   Mapping and inclusion in Cox's Bazar, Bangladesh

The case of mapping in Cox's Bazar, a large refugee camp network in Bangladesh, highlights the multiple purposes of digital mapping in a humanitarian context as well as the risks associated with lack of participation and an overly technical approach. Since 2017, Bangladesh has hosted more than 900,000 Rohingya refugees, mostly in the Kutupalong camp network near Cox's Bazar. An enormous, complex and dense city[5] was rapidly created, necessitating the creation of new maps for responders to assess needs and organise services. Multiple processes of mapping have been conducted in the camps, including of hazard risks, medical facilities and mental health support, and administrative boundaries, with varying levels of integration between them (Harrison et al., 2019).

Yet frustrated interviewees who worked on such processes reflected on conducting mapping in a highly politicised and contested environment. The distrust that exists within communities, between communities, government representatives and aid agencies, and between aid actors themselves, means that codifying key geographies, structures and services into maps is fraught with politics. Humanitarian agencies disagree on common identifying markers for facilities and structures, with persistent 'mistrust between the main agencies' still meaning 'even [common] basic vulnerability to hazard categories … just do not exist'. Without common markers, the utility of maps as a means of creating a shared understanding of needs is limited.

5.1   Boundaries

The politicisation of the response influenced many areas of camp administration, including the demarcation of the camp into suitably sized units for the purposes of service delivery. The mapping process of these divisions proved controversial. The International Organization for Migration (IOM) attempted to divide the camp into manageable units for operational purposes along the lines of 'Majhi' blocks: blocks that are under the responsibility of a Rohingya community leader favoured by the army that acts as a focal point for the delivery of services. The mapping of these blocks was originally envisaged as a straightforward representation of 'reality' and people's 'lived experiences'.[6] The mapping process was framed by its implementers as a stepping stone to a better understanding of each community and its needs. Yet, as other managing organisations argued, the Majhi role is problematic

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5   The camps have a population density as high as 8 square metres per person, compared with the minimum standard in international best practice of 45 square metres (OCHA, 2018: 13).

6   One interviewee described a similar discrepancy between 'official' delineations set by authorities and residents of displacement camps in Uganda, where residents commonly identified themselves as belonging to particular water 'tanks' around which daily life was centred, rather than UN Refugee Agency-set 'blocks'.

and unrepresentative, and depicting their governance in maps risked formalising it. This mapping process became embroiled within debates around governance and more democratic representation within the camp leadership.

Such disagreement demonstrates how mapping is a highly politicised and contested process, though it draws its legitimacy from technical language and perceived neutrality. It also demonstrates ambiguities around inclusion and mapping: although the Majhi system itself is not an inclusive one, a map of Majhi blocks would be the most accurate depiction of the lived experience of most of the camp's residents. Ultimately the proposed governance system of elected representatives was mapped, though not implemented. Five years into the crisis, many areas of the camp still lack a clearly mapped demarcation of internal boundaries.

5.2   Services

Other mapping initiatives appeared less fraught: a comprehensive map of all medical facilities, recording status and specialisms, was an important milestone for illustrating the quality of care and coverage across the camp, which could be used for monitoring purposes. The value of developing this common understanding in such a context was seen as crucial, and interviewees also reported smaller medical providers actively coming forward to be recognised as legitimate healthcare providers on the map. Such comprehensiveness could then be used as a basis for targeted interventions in areas of particular need. Heat maps using this information, and showing the walking distance to the nearest medical facility, provided an effective picture of inequalities in provision (see Figure 3). Yet interviewees also reported a disconnect between presenting such information and its use in other tasks, such as consolidating duplicating medical facilities to free up scarce land, with this process less successful.

Figure 3 Service accessibility analysis of primary health centres at a portion of Kutupalong Extension Site, Cox's Bazar

Source: REACH, 2018 (https://reliefweb.int/map/bangladesh/bangladesh-coxs-bazar-district-ukhia-upazila-service-accessibility-analysis-primary)
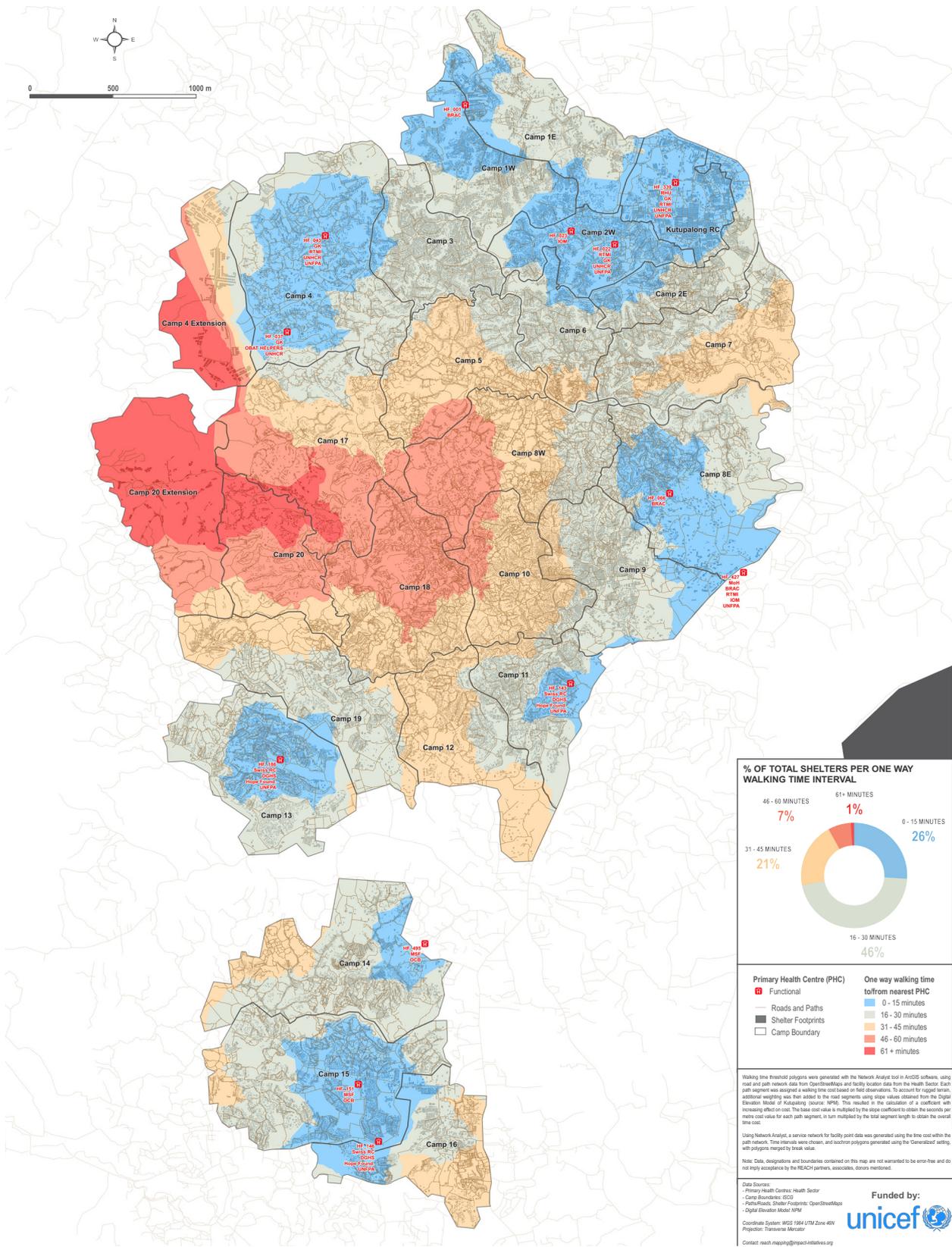
5.3   Hazards

Of the mapping processes in Cox's Bazar, flood and landslide risk was cited as the most important by interviewees, but also among the most contentious. With regional early-warning systems seen as 'insufficiently detailed', hazard mapping was created for the camps that combined data on land cover, topography, rainfall and other factors (Ahmed et al., 2020: 463). Yet for interviewees, this process was framed as being overly technical and often lacking participation from camp residents and verification from experts on the ground. By 2018, concerns were mounting over flooding and landslides in the next monsoon season, with mapping suggesting over 5,000 households were at the highest level of risk. Under pressure to adopt a 'no regrets' approach to intervening in advance of a predicted crisis, humanitarian staff repeatedly sought to convince residents to move. Persuading these households proved difficult, however: economic and social reasons meant few were willing to give up their land, and a planned relocation scheme ultimately did not materialise.

Staff tasked with carrying out such a process were informed by hazard maps, whose predictions and modelling in confident block colours presented an 'easy narrative' for concerned humanitarians and donors but oversimplified vulnerability. A former manager described this process in the camps as typical of the approach taken across the sector more generally, with a perceived over-focus on such risks at the expense of seeking a greater understanding of patterns of vulnerability (Peters, 2019: 33). The primary protection issue for interviewees in the Cox's Bazar context comes not from landslides but the host government: Bangladesh has expressed its wish to repatriate or move refugees as an alternative to expanding camps. The government repeatedly cites hazard risks as a key justification for this, and interviewees expressed concern that mapping processes that are overly technical and lack broader understanding of wider vulnerabilities could support this simple narrative. These early attempts at hazard mapping also suggest a 'tyranny of the map', as authoritative tools couched in technical language with an inaccessible methodology are used to inform decisions with far-reaching consequences. Such a technocratic process, from the perspective of one interviewee, also shuts down accountability, especially with inadequate participatory mechanisms.

The relationship between seemingly technical processes and the politics of the Cox's Bazar response is highly complex. Mapping has delivered much-needed clarity and has also been used to push for better services. For example, maps of health facilities were used to successfully advocate for government officials to allow these centres to construct semi-permanent structures in the place of more temporary ones. Since the host government has placed restrictions on the use of permanent buildings for service-provision, owing to its wish for the response and camps not to appear permanent, this was a major achievement.

Yet, while interviewees proposed that not every mapping process needs a participatory element, the level of involvement of camp residents remains generally low. This gap has been recognised by service providers, with recent overhauls of the various methodologies for calculating hazard risk to include a greater participatory element. Isolated examples such as consultations on which health services and providers were preferred by residents were seen as useful inputs into decisions over which facilities

to consolidate and improve. Yet such processes are also labour-intensive and can be hampered by a lack of standardisation between agencies and low levels of digital literacy among many humanitarian responders. This makes the development of adequate toolkits that can inform assessments challenging, and has led to what one interviewee described as a 'race to the bottom' to find common tools that humanitarian colleagues can readily understand and use for recording and sharing data. In the longer term, low levels of participation in mapping from both aid users and non-GIS specialist humanitarians could continue a cycle of overly technical framings, limited recognition of political and social vulnerabilities and heightened risk to vulnerable groups.

6   Towards more inclusive mapmaking

In humanitarian contexts, practitioners have to balance concerns around inclusivity with the practical realities of limited time and resources. This section reflects on the current state of efforts to improve inclusion in digital humanitarian mapping. It highlights three key issues: approaches to make maps more 'pluralistic' in how they depict places and contexts; the current debate around consent and the challenge of upholding the principle with digital tools and remote mapping; and how inclusivity in mapping is impacted by the programme cycles and funding of the wider humanitarian system.

6.1   Embracing plurality

Much of the exclusivity associated with mapmaking is a consequence of creating a single visualisation with limited features. As has been long argued in the field of decolonial and critical mapping, this positions the mappers as arbiters deciding what is important in any given context. This was the case in Cox's Bazar: a process of mapping administrative boundaries led to a disagreement between relief providers as to whether mapping should be a reflection of lived realities or a means to legitimise change. Such a disagreement also highlights a far wider issue with maps: that people living in those places may have entirely different perspectives and relationships to the land, neighbouring communities, built environment and services that are not reflected by those creating representations remotely.

The first step for those creating a more inclusive and accessible map that reflects the lived reality of those living there is to centre these users with appropriate language and terminology. One mapper working with migratory pastoralist communities in West Africa described how using more context-specific descriptive information, such as how long rainfall took to fill particular riverbeds rather than using millimetre metrics, created a more accessible and useful set of maps. These co-created maps may sacrifice depicting technical accuracy and formal political boundaries, but more accurately depict how pastoral communities understand and navigate seasonal routes.

In considering how to represent the diverse relationships that different people have with their surrounding environment, initiatives in the field of resilience provide interesting examples. As was seen in Cox's Bazar, many resilience-building activities use GIS tools and risk an overly technical framing that misses crucial aspects of the experience, skills and support networks of people affected by crisis. Since the built environment is easier to map, standard approaches may also over-emphasise the importance of physical infrastructure in measuring resilience (Comes et al., 2017; Ziervogel, 2017).

A more radical alternative is that of seeking to understand the web of human relationships that better determines resilience in all its complexity. So-called 'messy maps' can purposefully integrate qualitative data, such as audio-visual clips of interviews with residents, to depict who helps whom and where formal and informal responders are, challenging notions of an objective and technical view of reality (Cinnamon, 2020: 127; Taylor et al., 2020b). Rather than a static representation, such maps are intended to reflect the fast-changing and subjective relationships that each person represented has with their

community around them. This 'expressive mapping' has been piloted in the context of the Covid-19 response in Kibera and resilience programmes in Cape Town, South Africa, where psychosocial needs and residents' support networks were recorded alongside more traditional maps of medical and water and sanitation facilities (see Figure 4). Capturing these added elements in digital maps provides an added layer of understanding for authorities and responders, and goes some way to portraying a degree of plurality in such tools.

Such examples attempt to mitigate the single representation of a place that can prove exclusionary to different map users. The tools that digital mapmaking offers facilitate many of these alternatives. Rather than trying to present one 'objective' and 'true' summation of a context that will likely not be an inclusive one, approaches like 'messy maps' triangulate data from multiple perspectives that are acknowledged to be limited in isolation. Digital mapmaking makes this more inclusive process possible.

Figure 4   Example of a 'messy map' from the 'WhyDAR' project, showing the different ways that people are coping with flooding in the informal settlement of Philippi, Cape Town
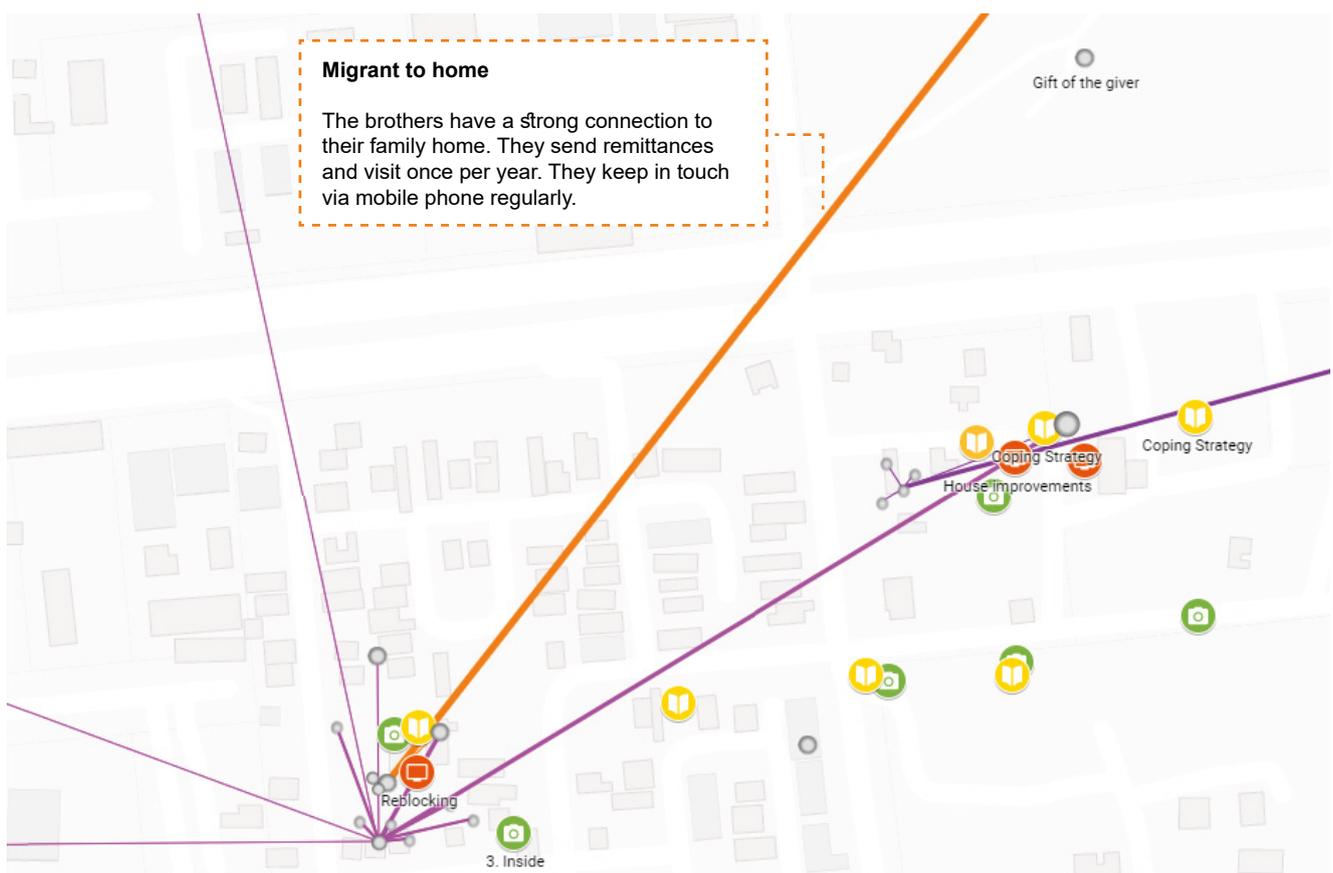
Source: The map was produced by King's College London in collaboration with the University of Cape Town, the Community Organisation Resource Centre and local residents (www.google.com/maps/d/u/o/viewer?mid=1kOXidVl_ Mmi_LODELT9EoXWloHI&ll=-34.002509177532765%2C18.575352939022714&z=18)

6.2   Communities and consent

Many technology-based interventions have been criticised for not providing communities with adequate means of giving consent. Instead, humanitarian agencies have been guilty of not adequately explaining to potential users what sensitive personal data will be used for, and not providing a viable alternative option through which to receive critical assistance. Yet the status of geolocated data placed on a map, and whether such information is sensitive and so should be similarly subject to the same process of consent, is less clear. The issue is complicated by the presence of 'demographically identifiable information', which can be misused to cause harm to populations even when the personal details of particular individuals are not collected.

Though the 'fear of invisibility' was reported by most mappers as being the most pressing issue for affected people in crisis, communities may refuse mapping for any number of legitimate reasons. Insecure land tenure impacts millions of people who must balance a wish for better services and visibility with the threat of eviction from or demolition of their homes (Kamalipour and Dovery, 2019). Indigenous groups may have differing claims to land than those of state authorities. In particular local examples, rural communities in the Democratic Republic of Congo feared their small-scale illegal lithium mines nearby would be destroyed if authorities discovered their locations on newly updated maps. In Canada, some First Nations community members raised concerns that surveying and mapping could be a re-traumatising event for elders, whose past participation in similar processes led to exploitation. Such cases highlight the need for a principle, put forward by decolonialism advocates, that the community living on the land should be able to exercise its authority as to whether their presence is made visible to a global audience, which includes actors seeking extractive relationships (Garcia, 2020). Existing ideas around reversing this process tend to focus on the notion that the open-source nature of these maps provides an easy means through which people can delete themselves, but this ignores both the barriers in access and skills needed to do so and also the ease with which details can be re-added by remote mappers.

Interviewees involved with mapping had mixed reactions to the proposal of a 'right to be missing'. In an isolated instance where communities had refused to be mapped, their wishes were accepted and no data was collected, though total control of that process by one actor, MSF, made that process easier and more direct. As was seen in the Cox's Bazar case, a technical framing of a mapping process can provide legitimacy and justification for a politicised activity such as refugee relocation. As interviewed practitioners recalled, affected people are well aware of the connection between mapping and the subsequent actions it can facilitate. In Tanzania, instances where communities were resistant to giving out information for a flood resilience programme were a consequence of previous experiences of evacuations where no subsequent compensation was provided. In such a situation, engaging with local leaders in order to clearly articulate the benefits of this assessment, such as more prompt emergency responses, was necessary. Similar advice was shared by a mapping colleague, who argued that 'what gets measured gets done', with regard to mapping forming a base from which to facilitate beneficial

programmes. A further interviewee proposed that, while such processes are important, 'it shouldn't necessarily derail the entire reason for doing maps. Ultimately your core philosophies dictate it – utilitarian principles might say it ultimately leads to more benefits for a wider group of people.'

Discussions around consent and what responsible and inclusive practice entails in digital mapping are still in their early stages, and several mappers admitted having many questions of their own around the issue. However, interviewees reflected on the general concern that a lack of viable alternatives makes it difficult to uphold principles of consent, with any notion of choice being slowly replaced with passive participation and inclusion by default. Reversing this trend is now seen as very difficult, though initiatives do exist of communities deciding on differing levels of exposure depending on how publicly available maps are and where they go. This is not without precedent: military installations and other sites considered sensitive are commonly excluded from similar resources. Ultimately, the consent issue as a facet of inclusion appears one-sided in favour of 'everyone is counted', and the alternative – that 'everyone *can* be counted' – requires proximity, contextual knowledge and participatory methods to carry out.

6.3   The limits of programme cycles and sustainability

Among the most important barriers to a more inclusive digital mapping process is a practical one. A fundamental issue in mapping in humanitarian contexts is that 'information rots fast' and quickly depreciates in value (Meier, 2017). Even outside of dramatic destruction brought about through conflict or disasters, critical infrastructure elements such as water points require frequent updating as to their condition, and many environments have dramatic differences between wet and dry seasons. Yet, while timeliness is among the most important elements of useful humanitarian mapping, mapping programmes and sustainability are rarely set up for this kind of constant updating.

Mapping projects tend to decrease after the critical stages of a sudden-onset crisis, to 'die when the crisis ceases to be critical' (Gutierrez, 2019: 104). This appears to be the case for both initiatives using proprietary software and those using open-source methods. An independent evaluation of UNOSAT's rapid mapping services showed high relevance but low sustainability, with its 'offering of a free service as a public good to the humanitarian community' threatened by project cycles and associated funding. Participatory mapping shares this issue, with the co-founder of Map Kibera reflecting that, despite the project's early successes and approach, 'it became clear that pure, open-ended, community-driven participatory development and social accountability ... was simply not going to be well-funded – if at all' (Hagen, 2017: 8). For remote participatory initiatives using OSM tools, sustainability among their volunteers is also an issue, with almost 70% of humanitarian mappers contributing just one day to mapping. This trend is only increasing, as the number of one-day contributors is rising, while mappers involved for longer have saturated (Herfort et al., 2020: 22). Those managing such programmes describe that this is likely due to the motivations of remote volunteers being reactive and driven by a desire to help in a specific context following news coverage. While invaluable for mapping work, one manager argued that this made it 'really hard to sustain or maintain those contributors over time'. As a consequence, some areas risk only being mapped in the initial aftermath of a crisis, leading to resources on many areas becoming rapidly outdated.

Aside from time considerations, a genuinely inclusive process, whereby mapped people use these resources for their own priorities, is also limited by the constraints of funding and individual programmes. Interviewees working in Cox's Bazar described the input of affected people being limited to a final-stage 'consultation' exercise of a larger project whose constraints were set by funding cycles. Projects with the potential for a far greater degree of involvement from service users, such as providing the means to report when water, sanitation and hygiene facilities required maintenance, were shelved in the face of more urgent activities. Similarly, mappers in the Philippines described how the communities they worked with engaged with their process to successfully diagnose safety issues in their area, but compiled a long list of pressing issues such as public transport infrastructure and streetlighting that sat outside of the project scope. Another example saw the involvement of affected people in a mapping project limited to reporting issues to be mapped by volunteers, rather than necessarily mapping themselves. Those involved were frustrated by the dynamic of dependency such exercises reinforced. If an inclusive process should provide affected people with the means to participate equally in a response rather than just supply information to be extracted, then many mapping initiatives do not meet this definition due to such sustainability issues.

While mapping is not the only humanitarian activity governed by the constraint of programme cycles, interviewees proposed that overcoming such barriers ultimately requires fewer restrictions on funding, more iterative approaches to mapping projects and a greater appreciation of such resources as a potential 'common good' for humanitarian responses and many other aspects of economic and social life. More realistically, others see the potential in soon to be 'effectively real-time data collection', through a variety of sources and AI analytical power, 'offering a solution to a perennial problem with maps' of outdated information (Johns, 2021). The concern for participatory processes is that the elements that determine inclusivity remain largely offline and are time- and labour-intensive to carry out.

7   Conclusion

The impact that digital mapping technologies have had on inclusive practice and responses cannot be known for certain: as just one tool for understanding context and needs, mapping is applied within a far wider world of different priorities and incentives. Yet there is clearly great value in making poorer areas or marginalised groups visible to aid responders and governments, and this often marks the first step to enabling improved analysis and campaigns of advocacy and accountability. Many mapmakers using open-source tools are motivated by a sense of contributing to a 'common good' and see the scope of their work and its potential benefits as wider than the immediate outputs of a specific humanitarian project. The creation of such 'global public goods' is a positive and necessary step to a more inclusive humanitarian system that can challenge the current exclusive international aid sector. Rather than recreating the same paternalistic and exclusive dynamics of the internationally dominated aid system, elements of open-source mapping projects also demonstrate how an alternative, networked means of global humanitarian response may work in practice.

Although a growing trend can be observed of increasing representation of people in humanitarian contexts on maps and in data, such representation does not necessarily lead to greater inclusivity. While maps achieve ever more granularity and accuracy, to the benefit of service providers and many other groups, the channels by which those mapped can access their own data or use it to assert their rights or sovereignty have not improved at the same pace. Efforts to include crisis-affected populations, such as the work of HOT-affiliated groups, are powerful but remain small in scale and not commonly used by the international humanitarian system. Mapping may not present as obvious a data mismanagement risk than other technologies, but extractive dynamics and the 'mosaicking' of data to identify groups constitute threats to both people already affected by crisis and to inclusive humanitarian responses. While the development of open-source platforms is a positive shift towards greater inclusivity, they too come with their own risks, biases and potentially exclusive dynamics that also mean inclusive mapmaking is not guaranteed. As with many other technologies deployed in settings involving marginalised people, it would be a mistake to not critically assess the 'presumed neutrality' of such tools (Krishnan et al., 2021).

The example of the various mapping initiatives of Cox's Bazar provides lessons in how mapping in a politically fragmented context can foster a common understanding, but also the risks of providing an incomplete picture of a crisis. Perhaps, above all, it demonstrates that framing mapping as a purely technical process that sits outside of political and social dynamics – and the perspectives of those being mapped – is an exercise that risks exclusionary responses. Technical 'accuracy' can be easily conflated with objective 'truth', and mitigating against this requires constant engagement and revision. In a humanitarian context, with such a gulf in power between mappers and those mapped, it becomes all the more critical to understand people's perspectives and lived experiences through offering a means of participation in codifying spaces and communities.

Some mapmakers have attempted to do this, decentring themselves and creating visualisations more intuitive to aid users, going so far as attempting to portray many different perspectives of residents

through 'messy maps'. These processes to varying degrees sacrifice the perceived objectivity of top-down maps to include less quantifiable experiences and perspectives that are just as important to the map's users. Such initiatives also help frame maps as an ever-changing, subjective tool, and only the beginning of a conversation. And though not being included is likely a more common concern among aid users than being included against their will, the right of individuals and communities to exclude themselves from any such representation should also be considered a key part of an inclusive mapping process. These ways to improve inclusion are, however, limited by funding, an over-dependency on volunteers and passive participation rather than consent, all of which carry different risks to inclusion. While increasingly automated mapping could address some of these issues, biases are built into AI, making a better understanding of the dimensions of inclusivity especially important in a humanitarian context, with heightened power inequalities and the likelihood for harm.

How can these lessons be applied to mapping in the future? Like other new digital technologies in the humanitarian sector, there has been an absence of an agreed-upon set of core standards, though that is changing: the 'GeoEthics in vulnerability principles' (Hagen, 2020) and the Locus Charter (2020) are early examples of ethical guidelines in geolocation. As has been highlighted, however, the proliferation of actors in the mapping space makes coordinating and upholding such principles increasingly difficult. Whether these will be sufficiently inclusive and decolonial is another challenge. As a more diverse set of perspectives are included in mapping, more nuances and impacts come to light, in a process positive for improving inclusion but challenging for the creation of any general principles. Yet, just as applying these tools in humanitarian crises means 'creating novel digital rights problems', the articulation of new rights by the users and targets of these tools themselves is also growing in prominence (Raymond, 2017; McDonald, 2021).

Mapping is an old activity and is in some respects the ultimate exercise in exclusivity, with mappers taking a top-down view and depicting what they consider important. Humanitarian responses also bring their own considerable historical baggage and exclusive dynamics between aid provider and beneficiary, as does technological development, which follows the priorities of those who pay for it. Pushing back against these trends to create tools and responses that are inclusive is a difficult but necessary task, and one already being pursued by mappers from both aid organisations and affected communities. Participatory processes, open-source platforms and advocacy groups are helping to break these exclusive dynamics, and creating maps more representative of the places and people they claim to depict.

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