



Promoting the Rights of Victims in Under-Resourced Places by Using Science and Technology That Can be Used by Ordinary People, to Deal with Human Rights Violations: Bolstering the Right to the Truth

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Abstract

This article argues that while the right to the truth has come to the fore over the last few decades, victims around the world have not really felt its practical effect. It is argued that for the right to have real impact, human rights violations need to be documented and investigated, and the victims identified. This has, however, been limited in the past for a variety of reasons, including the inability to document violations to the extent needed. The article therefore considers how scientific and technological tools can help with this. It is argued that while the right to the truth has been assisted by the advent of DNA analysis, this tool is often not available in large parts of the world because of a lack of resources. Thus, it is argued that other types of techniques can, and must, be used to identify victims of human rights abuses. The article considers how ordinary people and NGOs can use a range of other tools, including a variety of apps and social media, to collect evidence of human rights violations, find people and fight impunity. The article also discusses why there ought therefore to be a greater reliance on open-source information and how it can be used to improve documentation and investigations of human rights violations. Examples that best embody the advantages and disadvantages of these scientific and technological tools are provided, as well as ideas on how to overcome the challenges they present.

Keywords Right to the truth · Victims · Science and technology · Human rights violations · Human rights documentation

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Introduction

Human rights violations are at massively high levels around the world. (Sarkin 2018a) The number of people killed by their states or harmed in some way continues to be enormous. Many places have seen tremendous numbers of violations, such as Syria, Yemen, Afghanistan (during the ongoing conflicts) and North Korea, China and Russia (considerable ongoing and long-term human rights abuses) to name just a few states where massive violations are occurring. (Sarkin 2019) Documenting such abuses has usually been difficult because of a lack of access to those places by researchers from the UN and other international organisations who have been tasked with collecting information and providing evidence for future accountability processes because the state concerned denies access. Also, the researchers that have done the documenting have been few in number and have mostly relied on a few pieces of evidence from eyewitness testimony and other traditional sources. The role of international role players in doing the documentation has been important as the state will not usually do so and tries to halt others from doing so as well. Thus, the international community has taken on a critical role in human rights documenting.

However, in the past, generally speaking, very little information has been collected, and much of it by a variety of international or internationalised institutions set up over the last 30 years in order to hold perpetrators accountable (even though this hardly occurs for most places in practice). Little has been focused on victims' needs to truth and to get information on their loved ones. Few investigations have focused on who has been killed, how they were killed, and where their bodies are buried. These are significant issues not only for victims and their families, but also for societies, as who the dead are, how many there are, who died and where they are buried often has enormous political significance in a country (McEvoy and Conway 2004). However, efforts are frequently made to keep the answers to these questions concealed or to take steps to deny what occurred or who the perpetrators were. Moreover, the facts about the past are often manipulated to create fertile ground for the pursuit of corrupt political interests (Kingston et al 2017: 179), including by political leaders seeking to ascend to or remain in power. This is problematic because as long as the truth remains hidden, accountability is not possible, and conflict remains an ongoing possibility (Breen-Smyth 2007: 34).

The problem in finding the evidence for accountability and other purposes is that it is often impossible to get access to places where conflict or human rights violations are being committed. In this context, the use of technology in a variety of fields has advanced incredibly over the last few years. The technology is continuing to evolve rapidly, as is how it is being deployed. An array of technological solutions is being used to solve problems and document human rights violations as never before. This is particularly significant in an era where there is pessimism surrounding the human rights project and, in parallel, a rising scepticism regarding the use of emerging technologies (Gregory 2019). At this juncture, the zenith of the digital age, it is critical that human rights protection continues to be developed and improved using the digital tools we now have available to us.

With the use of technology, it has thus become possible to document gross human rights violations without accessing the places where those violations took place. This is being done using, for example, enhanced satellite imagery, photogrammetric reconstruction, lasers, remote sensing, ground radar, and other tools (Piracés 2018). There are also developments in artificial intelligence (Molnar 2019), machine learning and a host of other similar processes all of which can assist in doing work that involves extensive data that can be analysed using this type of technology.

The problem is that certain types of technology are often only available in wealthier parts of the world because of their cost. Thus, resources are a major impediment to the use of such technologies in poorer parts of the world, where they are out of the financial reach even of the state, and can therefore only be deployed in very few cases. There is thus an urgent need for more resources to help resolve this.

In the meantime, other means to the same end need to be found – generally, publicly and freely available alternative technologies. Open-source materials¹ and software and other cheaper technologies can equally be used to solve human rights problems in the absence of more expensive tools. The private sector and civil society both have a key role to play in the delivery of such technology. Already much work is being done in this regard, but more support for it, and more donor funding to civil society, is needed. This will ensure the wider-scale availability of these tools. Critically, the use of these materials can bring many new people into the human rights documentation field. People need very limited skills to be able to participate. Much can be self-taught or learnt through online sharing.

This article aims to indicate some of the scientific and technological tools that are able to bring the truth to light in a way that is objective and reliable (Gillespie and Alston 2012) but also that can ensure that ordinary people can and do contribute more to these processes. Concrete examples that best embody the advantages and disadvantages of these tools will be provided, as well as ideas on how to overcome the challenges they face.

In the first part of this article, the concept of the right to the truth is analysed. This right has multiple meanings, which will be scrutinised in order to better understand how the right can be ensured. However, despite its multiple nature, what matters in particular for the purpose of this article is that the right to the truth is universally recognised by international courts and human rights bodies.

The article then turns to how science and technology can enhance the right to the truth. In particular, it looks at how DNA and other forensic techniques can be used to find and identify human remains, ensuring justice for both victims and their families (Sarkin 2015a, b, c, d), as well as how DNA analysis and forensic anthropology can be used in combination. The discussion specifically considers how technology can be used by law enforcement and by individuals and NGOs. The next section of the article focuses on open-source information and how such information provides a wealth of useful data that can be used to improve investigations into human rights violations and ensure the right to the truth. The challenges of using all of these tools is discussed, as well as what can be done to overcome these problems.

¹ Defined as the "retrieval, extraction and analysis of publicly available sources." Best, (2008) 331.

The Meaning of the Right to the Truth in Practice

The need to investigate and document human rights violations has a legal basis in a variety of areas of international law. That is because the right to the truth is found in international law, although it is not always explicitly delineated as such. It has in the past been derived from a number of rights. Already in the 1980s (Ferrer Mac-Gregor 2016), the Inter-American Commission on Human Rights asserted that “every society has the inalienable right to know the truth about past events, as well as the motives and circumstances in which aberrant crimes came to be committed, in order to prevent repetition of such acts in the future” (Méndez and Bariffi 2012). Thus, the right has both a societal and individual dimension.

As far as the right to the truth for individual victims is concerned, it is widely accepted that the first major decision upholding this right is to be found in the *Velásquez-Rodríguez* case of 1988 (González and Luis 2010). In that case, the Inter-American Court of Human Rights found that the state had the obligation to investigate and disclose information about the facts of the case to relatives of victims. It held that states are obliged to investigate every situation where protected human rights have been violated, an obligation which “continues as long as the uncertainty about the whereabouts of the disappeared persons remains” (Inter-American Court of Human Rights *Velásquez-Rodríguez* para. 176). Thus, theoretically, the right has had a long history that today means that, if fulfilled, much knowledge and information should be flowing to victims. However, the practical ramifications have not always been felt because of the inability in practice to realise the right.

The critical issue is that while the right to truth is now found far and wide in international law, the realisation of that right in practice has not really been felt. For example, while accountability for perpetrators is much more available in international criminal law, and victim participation in those processes have also been enhanced, their right to truth has not really been met. As has been noted, “the primary, and perhaps most important, right of victims in the context of international criminal proceedings is their right to the truth” (Mettraux 2010). However, this has not really been really met. Victims want to understand the causes that led to the commission of grave violations. They want to know the circumstances in which they occurred. This hardly occurs for the majority of the victims. It has been met much more for societies, that want to know who the victims are, which groups they came from, and why they were targeted by a range of UN Commissions, truth commissions and other processes. These types of knowledge can more effectively contribute to the prevention of future crimes but do not adequately meet the needs of individual victims (Sarkin 2015a, b, c, d). Today, when so much truth is disputed, getting to the truth is difficult (Banks and Hulsen 2019), but much more necessary (Kim and Katsanis 2013; Blakemore, Bossomaier, Foy and Thomson 2005).

Therefore, the right to the truth has become widely recognised over the last few decades. It has even seemingly been accepted by some as a norm of international law (Naqvi 2006). However, Sweeney is more critical of the extent to which

the right actually exists and observes that there is, “clearly a groundswell of international opinion in favour of recognizing a right to truth, but this does not translate straightforwardly into international legal rights and duties.” (Sweeney 2018: 357) However, the right does occupy a particularly important position in both international human rights law and international humanitarian law (Méndez and Bariffi 2011: 4). The International Red Cross and Red Crescent Movement has even argued that the right to the truth has attained customary international law status in relation to both international and non-international armed conflict, stating that “each party to the conflict must take all feasible measures to account for persons reported missing as a result of armed conflict and must provide their family members with any information it has on their fate” (Rule 117 in ICRC 2005: 421). However, once again, while available as a right, in humanitarian law the practical effect has been limited: Few of the multitudes of violations that occur during conflicts are documented or investigated, leading to information for the victims or accountability for the perpetrators.

As far as disappeared persons are concerned, the right to the truth is now to be found in treaty form in the International Convention for the Protection of All Persons from Enforced Disappearance, adopted in 2006 (Sarkin 2014). In the Preamble, the right to the truth is delineated as “the right of any victim to know the truth about the circumstances of an enforced disappearance and the fate of the disappeared person, and the right to freedom to seek, receive and impart information to this end”. Article 24(2) provides that “each victim has the right to know the truth regarding the circumstances of the enforced disappearance, the progress and results of the investigation and the fate of the disappeared person”. However, this rarely happens in practice, because of the few investigations and little evidence that exist to aid the search for such persons. Because of this, it is thought that there are millions of cases of disappeared persons around the world whose cases have never been resolved.

Many UN documents also affirm the importance of the right to the truth in combating impunity and contributing to the attainment of peace (Groome 2018: 259). The United Nations Principles to Combat Impunity state that the right to know is not “simply the right of any individual victim or closely related persons to know what happened, a right to truth”; it is also a collective right, “drawing upon history to prevent violations from recurring in the future”. Again, both the individual and collective aspects are seen, but the practical realisation has been limited. This is the case despite the UN publishing a study on the right in 2006. That report recognised it as an inalienable, autonomous and non-derogable right that is possessed by victims, their relatives and the wider society (United Nations Office of the United Nations High Commissioner for Human Rights 2006; Groome 2018: 259). The study recognises the right to know the truth about the victims’ past, their relatives and society, separate from the right to justice, which implies that states ought to implement concrete measures to ensure the effective delivery of the right to the truth (United Nations Office of the United Nations High Commissioner for Human Rights 2006). The study also finds that from the right to the truth emerges an “entitlement to seek and obtain information on: the causes leading to the person’s victimization; the causes and conditions pertaining to the gross violations of international human rights law and serious violations of international humanitarian law; the

progress and results of the investigation; the circumstances and reasons for the perpetration of crimes under international law and gross human rights violations; the circumstances in which violations took place; in the event of death, missing or enforced disappearance, the fate and whereabouts of the victims; and the identity of perpetrators” (UN Study on the Right to the Truth 2006). It furthermore suggests that states have a duty and obligation to protect and guarantee human rights, to conduct effective investigations and to guarantee effective remedy and reparations (Sarkin 2006). Finally, the study emphasises the role of trials and truth commissions in promoting the right to the truth. While some disagree with the methodology of the Study, (Sweeney 2018) again, all these aspects of the right have not meant much in reality, as the investigations and evidence collection have been inadequate.

On the recognition of the right, in a similar vein to the 2006 UN Study, the Human Rights Council in 2009, shortly after it came into being, adopted a resolution on the right to the truth, calling upon states to take appropriate action in order to facilitate efforts by victims and their next-of-kin to determine the truth about gross violations of human rights. However, again, the practical realisation and actual effects of this resolution have been very limited. This is in part because of a lack of political will by some states, and because other states do not have the skills and resources to carry out proper investigations to amass the required evidence, as well as other limitations.

While international criminal courts have made a contribution to the development of the right to the truth, their reach has been limited because of the few cases they take up. Thus, while the Rome Statute of the International Criminal Court has played an important role in the realisation of the right, very few victims overall are affected by each of its few cases and decisions overall. It is also expensive to rely on international courts, which cost a lot to run and to collect the evidence they need. They cannot reach even a fraction of one percent of victims.

The right to the truth is also found in regional systems. The European Court of Human Rights (ECtHR) recognised the right in *Cyprus v. Turkey*, stating that “the silence of the authorities of the respondent state in the face of the real concerns of the relatives of the missing persons attains a level of severity which can only be categorised as inhuman treatment within the meaning of Article 3 [ECHR]” (European Court of Human Rights *Cyprus v. Turkey*, 2001, para 157). However, despite the ECtHR’s recognition of the right in this case, progress in finding the disappeared people in Cyprus has been slow. Even though the conflict ended 50 years ago, many victims still have not been found because of a lack of information on their whereabouts.

How the Use of DNA Promotes the Right to the Truth

The science of identification of human remains has cemented itself as a lynchpin in the international justice system (Smith 2017). The exhumation of clandestine mass graves, the returning of remains to bereaved families, and the identification of the disappeared, maimed, tortured and murdered continue to serve the interests of justice (Uberaker, Shamlou and Kunkle 2019).

If the right to the truth, among its diverse interpretations, also means the right to know the fate of those who have suffered an enforced disappearance and those who have gone missing in international and non-international armed conflict, it is natural to conclude that the use of DNA analysis is an extremely helpful tool to ensure this right (Wagner 2008). It is today the most powerful weapon in hands of forensic scientists in the field of victim identification (Lorente et al. 2012), especially when there is insufficient ante-mortem evidence (i.e. information about the person, as well as clothes or other means of identification) and traditional forensic anthropology shows its limitations (Hanson 2008: 17).

DNA is particularly useful in the search for missing and disappeared persons for several reasons: it is unique to an individual, it is very resilient and it can be preserved in hard tissues such as bones and teeth that are largely protected from the effects of putrefaction and decomposition for years, allowing the comparison with other profiles a considerable amount of time after the person's death (Budowle et al. 2005). As a result, the use of DNA analysis has dramatically improved the identification of remains, even if a long period of time has passed since the person went missing or disappeared (Hartmana et al. 2011).

In comparison with traditional techniques which have proved insufficient when large numbers of victims are involved, modern DNA analysis allows the precise identification of a large number of people relatively quickly, and its cost has come down substantially over time (Boles et al. 1995). Using next-generation sequencing (Behjati and Tarpey 2013: 236–238), it is now also possible to process large quantities of DNA quickly and ascertain the identity of a person with only a drop of a distant relative's blood. Computer programs have also been developed to allow thousands of profiles from victims and their families to be compared. This is crucial not only for identifying victims of recent conflicts, but also for large numbers of families who lost their loved ones in conflicts that occurred in the less recent past, because these developments make it possible to process DNA even when the samples are degraded.

Although there is no method that guarantees 100 per cent accuracy when identifying victims' remains, it is indisputable that DNA testing – which is more precise than traditional methods of identification – has improved the process, helping to avoid the misidentifications that were at times made in the past (Romeika and Yan 2013). Traditional methods of identification are however still widely used, especially where more modern technology is not really available or is unaffordable. These traditional techniques, based primarily on visual recognition of personal effects or the body itself, are however more likely to have success if used soon after a person's death (Jobling and Gill 2004), which in the context of human rights violations, especially disappearances, is not usually possible.

To take the former Yugoslavia as an example, in the years after the end of the war various attempts were made to identify remains using traditional methods. However, more recently, the use of DNA analysis, together with other forensic approaches, has seen many remains being correctly identified, which has then allowed them to be handed over to families (Robins 2009). As a result, it is estimated that approximately 30,000 disappeared persons from Bosnia-Herzegovina have been accounted for (Bennett 1995). There they have used a range of technology to find, recover and

identify (Huffine, Crews, Kennedy, Bomberker and Zinbo 2001) people (Wagner 2008) who were disappeared by the state (Baraybar and Gasior 2006) during the conflict in the 1990s (Zwierzchowski and Tabeau 2010). DNA technology, especially, allowed many people to be identified using reference samples from their family members (Huffine, Crews, Kennedy, Bomberger and Zinbo 2001: 271–275). This is the first time that massive processes (Biesecker et al. 2005: 1122) were undertaken to find those who were missing (Hirschel and Lab 1988) or disappeared (Sarkin 2015a, b, c, d). This has provided enormous comfort to many of their families (Parr and Stevenson 2013).

An important role in the development of the use of DNA in relation to missing or disappeared persons has been played by the International Commission on Missing Persons (ICMP), which is now one of the premier organisations using DNA processes for identification purposes (Sarkin 2014). Its mandate is to locate and identify persons missing as a result of conflicts, abuses, organised crime, irregular migration and other causes (Sarkin 2014). The ICMP has systematically collected over 100,000 reference samples in Bosnia-Herzegovina for DNA analysis, representing the families of tens of thousands of persons reported missing or having disappeared. This will be discussed further below.

Thus, the advances in DNA analysis have ensured that the right to the truth can be implemented even when temporal circumstances would tend to deprive victims and families of their entitlement to the right to the truth. They can then also get closure and bury their loved ones (Eppel 2002: 869).

The Availability of DNA Technology Around the World

While DNA analysis is widely available around the world it is rarely employed in many countries because of the skills needed to use it and the costs associated with using it. While the costs of using DNA technology have come down (Holland 2011), it is still expensive and crucially more expensive to use in some places where the technology is only available in limited ways.

As far as where it is used, it seems that only 64 countries have functioning forensic DNA databases (The Forensic Genetics Policy Initiative n.d.).² Thus, the majority of countries, especially those in the poorer parts of the world in Africa, Asia and Latin America, do not have such tools. Furthermore, in all 64 countries that have them, the databases are small in size and cover very few people. Thus, even the databases of large, relatively rich countries like China (DNA samples of 40 million persons, supposedly to surveil groups such as Uighurs in Xinjiang) and

² Austria, Australia, Bahrain, Belarus, Belgium, Bulgaria, Botswana, Canada, Chile, China, Colombia, Croatia, Cyprus, Czech Republic, Denmark, Egypt, Estonia, Finland, France, Germany, Hungary, Iceland, Israel, Indonesia, Iran, Israel, Jamaica, Japan, Jordan, Korea (Rep. of), Kuwait, Latvia, Lithuania, Luxembourg, Lebanon, Macedonia (FYR), Malaysia, Montenegro, Morocco, Namibia, Netherlands, New Zealand, Norway, Panama, Peru, Poland, Portugal, Qatar, Romania, Russia, Saudi Arabia, Singapore, Slovakia, Slovenia, South Africa, Spain, Sudan, Sweden, Switzerland, Ukraine, United Kingdom, United States, United Arab Emirates, Uzbekistan. (The Forensic Genetics Policy Initiative n.d.)

the US (DNA samples of 16.2 million persons in the FBI's Combined DNA Index System (CODIS), which includes missing persons) cover relatively few persons as a proportion of the total population of the country (Toom 2018: 22).

When it comes to the use of DNA for criminal detection, Interpol found in 2008 that only 120 countries were using it (Wallace et al. 2014). In 2016, though, Interpol reported the results of a survey amongst states that indicated that out of the 95 member states that responded (of a total of 190), 84 countries used DNA profiling and 69 had a national DNA database. Thus, the number of countries using DNA technology to deal with crime has increased, but in many countries its usage is still not widespread. While it can be argued that these databases do not represent the total use of DNA, and the figures do not reflect its use for human rights purposes, what is true is that the existence of a DNA crime database is somewhat reflective of DNA use generally by a state. This is because state DNA databases usually indicate the extent to which DNA processes are being used publicly.

Private use of DNA does occur, with many private companies offering DNA services have been established all around the world. However, such services are generally available to and affordable by wealthier individuals, who usually reside in richer countries. In many other places, with some exceptions, DNA services are less available, and are very costly when they are available. Thus, for example DNA has seldom been used to identify the thousands of victims that died during the conflict in Colombia (Ferllini 2007: 196).

When it comes to databases for human rights purposes, very few countries have created them. For example, very few countries have created missing persons databases (Interpol 2015), even if the number of missing persons there is massive. For instance, about 700,000 persons go missing every year in the USA (Sarkin 2015a, b, c, d). The numbers of missing migrants that cannot be found as a result of their travels is enormous (Sarkin 2018b). Moreover, few DNA samples are collected from the families of missing persons to be matched if a person is found. This is a particular problem in poorer parts of the world, where states and the families of the missing do not have the resources to do so.

In fact, dealing with human rights violations and collecting evidence of those abuses is far less likely in poorer parts of the world because of the lack of political will and the lack of commitment of resources to deal with them. In these places, the availability of other scientific and technological tools to investigate and take other steps to deal with human rights violations is also limited (Rosenblatt 2015). Generally, the only time that widespread usage of such technology is possible is when the international community gets involved. Thus, as noted above, in Bosnia-Herzegovina this was only through the involvement of the ICMP. There, it was possible to determine the fate of nearly 28,000 persons (out of about 32,000) who were disappeared in that country during the war that followed the breakup of the former Yugoslavia. While Bosnia-Herzegovina had established a Missing Persons Institute (MPI), it was only because of the resources and pressure of the ICMP that so much occurred in the way of mass grave detention, exhumations and identifications, usually using DNA analysis. Nowhere else have so many persons been able to be found and their identified remains handed over to their families. Although DNA analysis is particularly rare in human rights cases in the global south, it has been

used when assistance from elsewhere has been received. For example, in Argentina the Madres de la Playa de Mayo received the assistance of Physicians for Human Rights from the USA, which allowed DNA tests to be done to identify the children removed from their families during the Argentina junta in the 1970s (Murthy and Smith 2010: 78).

This does not mean, of course, that this technology and the skills for human rights work does not exist in the global south; it does. For example, in Argentina, the Argentine Forensic Anthropology Team (EAAF) is involved for instance in the collection of reference samples for people missing along the US–Mexico border. However, it has played a role in many many other places around the world, where much reliance has been placed on them for a long time already. Likewise, in Guatemala the Fundación de Antropología Forense de Guatemala (FAFG) has been playing a similar role. However, these institutions are not well resourced, and while they regularly assist other countries, their ability to assist has been limited by resources.

To try and enhance identification processes, and the lack of national databases as discussed above, suggestions have been made for a universal national DNA database and some countries have contemplated a national DNA database (including Rwanda in 2019) that includes the DNA of all the people in their countries (Hazel et al 2018). However, in the case *S. and Marper v. United Kingdom*, the ECtHR has already rightly put the brakes on the use and retention of DNA samples as well as other biological referencing materials in Europe. However, the Prüm Convention of May 2005, then converted to the so-called Prüm Decisions and later agreements with various countries, allow for DNA exchanges between states for crime investigation purposes (Toom 2018: 2).

Combining DNA Analysis and Forensic Anthropology

While many people believe that DNA analysis solves all problems, when it comes to identifying missing or disappeared persons this is not always the case. For example, as noted above, reference samples are needed for comparison with the DNA of the person found, but these are not always available, for a variety of reasons, including the unwillingness of families to provide them, believing to do so is to accept that the person is dead. Thus, other techniques are needed alongside DNA analysis.

One of these is forensic anthropology, which is the application of archaeological techniques to legal investigations. This field has evolved rapidly over the last few decades (Komar and Buikstra 2008), resulting in a wide diversity of techniques that can be used to find and interpret sites of human rights violations that have been buried, concealed or for some other reason not found (Dirkmaat 2012: 447). In the words of Claire Moon, “forensic anthropology has come to play a critical role in the adjudication of past atrocity and the amelioration of human suffering” (Moon 2014).

Forensic anthropology was for example used in the *Krstić* case at the International Criminal Tribunal for the former Yugoslavia (International Criminal Tribunal for the former Yugoslavia *Prosecutor v. Krstić* 2001). There, the Court relied on evidence resulting from the exhumation of mass graves and provided by experts to show what

happened and prove the crime of genocide (Klinkner 2008). Forensic experts were able to prove that the majority of bodies exhumed were killed not in combat but in mass executions. The forensic analysis also revealed that some of the victims were disabled, providing clear proof that they were not combatants. Further, the work of anthropologists demonstrated that the primary mass graves had been dug up and the bodies reburied in other locations (Jessee and Skinner 2005; Haglund 2002). This also provided evidence of the perpetrators' genocidal intent because of who the victims were and how they were killed (Fournet 2017: 6). Putting all these elements together, the judges concluded that "there is a strong indication of the intent to destroy the group as such in the concealment of the bodies in mass graves" (International Criminal Tribunal for the former Yugoslavia *Prosecutor v. Krstić* 2001 para 596). Proving who were in the graves helped judges to provide a justification for the sentence and convict the accused of genocide, but to that end it was not necessary to prove, for each individual killing, the identity of the victim or how many victims there were. Therefore, while DNA analysis was useful to the extent that it helped in the identification of a decisive element for the qualification of genocide, all the other elements mentioned above were the work of forensic anthropologists.

The combination of DNA technology and forensic anthropology used in human rights work can be explained by Claire Moon's concept of "forensic humanitarianism" (Moon 2014). Forensic humanitarianism amalgamates the field of scientific enquiry and the forum of the law, therefore possessing an adjudicative function and an ameliorative function. It is ameliorative in the sense that it seeks to provide families with solace and closure, rounding off their suffering. It is adjudicative in that its insertion into the legal domain has resulted in material investigations and prosecutions, has buttressed accountability, and has therefore strengthened the legal institutions that uphold democracy (Moon 2014). In combination with the other latest developments, these scientific-technological tools are able to exponentially improve all these processes (Zietkiewicz et al. 2012).

Using Science and Technology to Deal with Human Rights Violations, Find People and Fight Impunity

The nexus between human rights, science, technology, democracy and development indicates that these variables are intimately related (Karim et al. 2018). This has made it increasingly complex to disaggregate advances in one domain without evaluating advances in the others. Information and communication technologies have reshaped patterns of communication between humans in this relatively new world of global surveillance (Karim et al. 2018). What is clear is that technology enables collective mobilisation and empowers ordinary people to get involved. At the same time, science has fostered innovation and driven human capability to new heights. Therefore, both science and technology should remain on the agenda for how the international community interacts with mass atrocities and documents human rights work going forward.

Advanced technological devices and processes can detect a great deal of information – often more than a witness can (Freeman 2017: 283). Although there are concerns with regard to the right to privacy, technology can help to track people and events in a variety of ways (Chesney and Citron 2019: 1753), outlined below.

Using Computer Technologies

One example of how computer science has been used in searching for missing people is through the use of missing persons profiles on Facebook (Dubberley 2019). Facebook has algorithms (Christin 2017; Croteau and Hoynes 2018) to identify people by their faces (Bucher 2012). These can be used to digitally identify a person who has been found or if their image, even in video form, becomes available. As software can age a photograph, finding missing people becomes more possible, even when a considerable amount of time has passed since the person went missing.

It is also now possible to investigate human rights violations remotely using hardware, without a physical presence on the ground being necessary (Strawser 2013: 1). One such technology, increasingly being used around the world, is drones (Choi-Fitzpatrick 2018; Carruthers 2018). Drones are particularly helpful for accessing areas that might be dangerous or inaccessible. They can take videos of the area, as well as allow a variety of other tools to be deployed to, for example, map the area or find gravesites, and so on. As well as being used in search and rescue missions (Karaca et al. 2018) and to help guide people to safety (Van Tilburg 2017), drones can also help in situations where it is crucial to respond quickly, especially when people go missing as a result of conflicts, human rights violations, disasters or organised crime (Tatsidou et al. 2019: 1314). They can be and have been used by ordinary people to record events and places where events have occurred, sometimes streaming them in real time.

While they do, in normal circumstances, pose serious privacy concerns (Altawy and Youssef 2016: 1-25), these can be dealt with by way of privacy and data protection laws (Scharf 2019: 1065). However, as the European Court of Justice has stated (European Court of Justice, *Digital Rights Ireland and Seitlinger and Others*, 2014, para. 51), the circumstances affect the types of investigative techniques that can be used. This could mean that it will not be considered unlawful in terms of data protection standards to use open-source data that include personal data when the purpose can be legally justified, such as to record or investigate human rights abuses.

Technology for Individual or Civil Society Use

The availability of technology and the digital literacy of ordinary people is at an all-time high (Polizzi 2020: 1). Technology is now available that most laypeople can use. As António Guterres, then the UN High Commissioner for Refugees, and now UN Secretary-General, noted: “The role of the private sector is increasingly important for humanitarian assistance. Lending their knowledge and expertise to support the

refugee cause is crucial as many of these projects would otherwise be outside of our reach. Today mobile phones are everywhere. It is used by almost everyone and then for multiple purposes. They can take pictures, videos, stream events, post to social media, this list is endless. Most importantly they are communication tools.

Thus, ordinary people (McPherson 2015), activists or human rights organisations can conduct human rights documentation work (Bruns Highfield, and Lind 2012). By connecting information and data available in the digital world – which is publicly available evidence, as will be discussed later – they are able to reconstruct what happened (Ristovska 2016). Thus, private citizens are becoming the new eyes and ears of democracy (Ristovska 2016).

Involving individuals around the world is a major boon for documentation purposes. An array of technology is being used to collect this type of information and post it to social media. For instance, the International Bar Association has developed an app called “Eyewitness to Atrocities” to help witnesses capture images on their smartphones in such a way that the images can subsequently be used in court. Images are encrypted and stored in secret locations on the smartphone and later uploaded to a secure offline server. A copy of the image is taken, decrypted and added to a database for later use.

Another app, developed by the NGO Physicians for Human Rights is called MediCapt (De Oliveira Musse, Santos, da Silva Santos, Dos Santos and de Melo 2020) and aims to prevent sexual violence. The app has its origins in repeated episodes of sexual violence in the DRC and the determination of representatives of more than 100 women to find the perpetrators. In the past, many of these types of cases had failed due to lack of evidence caused by minimal resources and the fact that forensic medical examinations are rarely conducted. In light of these challenges, the goal was to bolster local accountability and support a network of medical, law enforcement and legal stakeholders to improve collection and documentation of evidence of these crimes – for which purpose MediCapt was invented. This forensic app merges standardised medical information and forensic photography (Farid 2016) to create a medical record stored on the cloud, which police and lawyers can then access. It became an extremely useful tool in gathering evidence that might otherwise have been stolen or lost for a variety of reasons. This has the potential to bring more evidence to court and ensure justice for those who have been victims of sexual abuse and to make sure that these violations do not happen again.

As far as missing persons are concerned, the NGO REFUNITE (Robehmed 2019) uses technology to put refugees in touch with their families (Bock et al. 2020). Together with Ericsson, the IKEA Foundation, Zain, Vodacom, Free Basics by Facebook and others, it has created a platform that helps displaced families to search for missing loved ones through a text message, a phone call or on the web platform (Nasr and Fisk 2019). It has an online database of more than 1 million users where people can search for their loved ones who have escaped from disasters, persecution or conflicts (Ball 2016). It has reconnected more than 40,000 families around the world.

Another example of bringing together science and technology to support the relatives of missing persons is the WatchTheMed project (Schwarz and Stierl 2019). It is an online platform (Lodi 2016: 103) that documents the deaths of migrants

and violations of their rights on the maritime borders of the EU (Berendt 2019). It works in cooperation with activists, migrants' rights organisations and researchers, and through the analysis of ocean currents, winds, mobile phone data (Koettl 2017) and satellite imagery (Herscher 2014) to provide a reliable reconstruction of past events. WatchTheMed also seeks to support organisations to force authorities into respecting their obligations at sea and to bring legal proceedings against those who violate the rights of migrants (Topak 2019).

Similarly, the research project "Liquid Traces" uses technology to provide evidence to families and NGOs of the EU's failures to prevent refugees from drowning at sea, through the use of sea-current models, satellite images and other public sources available on the Internet (Laakkonen 2019). The project does this to provide a reliable reconstruction of the fate of migrants who have lost their lives while drifting for many days within the NATO surveillance area (Lo Presti 2019). The trajectory of boats can be determined via geo-reference locations from different sources, and with the assistance of organisations such as the Woods Hole Oceanographic Institute, which uses wind and current data to model the position of objects in the open ocean (Prokaev 2020). Information about the position of boats is also collected through electromagnetic signals and other types of hardware (Coury 2019). Further help in reconstructing events can come from satellite imagery (Rothe and Shim 2018), which can confirm the presence of ships by using sensing technologies and automatic identification systems. On the basis of this (Heller et al. 2012) and other investigations, a coalition of NGOs has been able to file legal cases against several NATO states.

These platforms are necessary, as unfortunately, when it comes to dealing with migration problems, Europe does not have a common system to find missing persons. Over the last five years thousands of people having died or gone missing along migration routes in the Mediterranean. The migration crisis, and in particular the problem of identifying the thousands of migrants trying to reach Europe, is a hugely complex issue that countries cannot solve on their own. Thus, the collection and use of data are key components of dealing with human rights violations in the context of migration specifically, but also to find other missing and disappeared persons.

Using Open-Source Data

Another development in the struggle to protect the human rights of people around the world is open-source information (Dubberley et al. 2020). Some of the use of open source technology was discussed above.

As far as what it is, open-source material is any information that is available on the Internet from a wide variety of sources, such as social media, online news articles, expert and NGO reports, image and sound recordings, satellite imagery, geospatial imagery (Drake and Harris 2018), mapping data and much more (Dubberley et al. 2020). It is information that can be accessed without the need to seek a warrant or employ other coercive or illegal measures (Human Rights Center

School of Law University of California, Berkeley 2018). The benefit of this type of information is that it is available to everyone and can be used by anyone.

Open-source information is becoming an increasingly important source of evidence of human rights violations (Mehandru and Koenig 2018: 129). Ordinary people can use it to gather critical information about such abuses (Aday and Livingston 2009). This can include collecting information for trials and ensuring that relevant evidence is obtained before it gets destroyed or removed from the scene of human rights violation (The Human Rights Center 2014: 4).

Where access to places where human rights violations have been committed is not possible (Powers 2016: 401-416), open-source information often allows investigations to continue. Publicly available satellite images can, for example, be used to identify where an event took place (Livingston 2016), such as the location of mass graves in Bosnia-Herzegovina. Once the location of an event is determined, it is possible to establish lots of other information. Similarly, Human Rights Watch (Fortune 2018) documented the chemical weapons attack in Ghouta, Syria, without even accessing the place where it happened: it was able to establish entirely through satellite imagery, photos and videos that the event occurred and that the Government of Syria was responsible (Ri et al. 2019).

These techniques were also used in investigating the bombings that took place between 1 and 4 August 2014 in Rafah, Gaza. Forensic Architecture and Amnesty International produced a detailed report entitled “Black Friday” to explain the succession of events (Ferreira, Carvalho et al. 2019: 91). Since the investigation team was denied access to Gaza, an architectural model was developed to reconstruct the events from pictures and videos, recordings of journalists, testimonies from victims and witnesses, news and media, public statements and other information from official Israeli and Palestinian sources (Forensic Architecture and Amnesty International 2014). To develop the model, the investigation team analysed various images and videos posted online by witnesses showing several bomb clouds (Forensic Architecture and Amnesty International 2014). Using the shapes of these clouds, they were able to compare the different image sources with the clouds on certain days and in certain places and thus determine the reliability of the images. The clouds thus allowed the spatio-temporal reconstruction of the events. Then, by looking at the surrounding architecture the team could pinpoint the exact site of the airstrikes. Images taken by witnesses on the ground were also used to help with this. To determine the exact time of day the bombings occurred, satellite images taken over Gaza on that day were examined. The bomb clouds could be seen by zooming in on the images, and by observing the changing shape of the clouds, it was possible to establish the exact time of the bombings using the timestamp on the image.

At this point, the investigation team were able to create a timeline of events integrated with witness testimony and look at the human rights violations that had occurred. Using all the sources at their disposal, the team created an architectural model that allowed them to move through the city and look at each image provided from its exact location (Forensic Architecture and Amnesty International 2014). From some sources, they were also able to obtain images of the bombs at almost the exact moment of impact. They then put these images into the architectural model

in order to measure the impact of the bomb, and by cross-referencing this against a catalogue of options they were able to conclude that one-tonne bombs were used.

Verification of open-source data is of course a critical issue; fortunately, there are now many tools and approaches available to help with this. One example is photo forensics. In part, this technology makes it possible to identify whether or not an image was photoshopped by using “error analysis” to show what the original image should look like (Miller 2017). Even when an image is un-retouched, its utility for an investigation may be uncertain because it needs to be contextualised; knowing when and where an image or video was taken is a fundamental part of the investigation into its veracity, reliability and hence utility. A helpful tool for verifying this aspect of an image or video is SunCalc, an online application that identifies where and when an image or video was taken by calculating the position of the Sun based on the shadows in the image (Rahman et al. 2019).

Conclusion

Every year, millions of cases of human rights violations never get documented or investigated. This is because of the inability of those who investigate or research them to get the information they need to bring these cases to the fore. As a result, impunity is a massive problem around the world: the vicious cycle of no investigations causes impunity, which leads to more violations.

Today, however, a wide variety of scientific and technological tools are available to human rights researchers and investigators and are indispensable to their work of gathering evidence of human rights abuses. DNA analysis and other technological and scientific processes and instruments are able to provide reliable information that can be used in the reconstruction of past events. Through the analysis of buildings, satellite images, user-generated footage, videos and other available evidence, acts of violence can be reconstructed, and evidence collected. Conflicts and human rights violations can thus be documented from multiple directions as means of promoting accountability and allowing victims to gather information that is vital for them to learn about the events that caused the victimisation. People can also be found and identified, which was often not the case before.

The mobile phone and the Internet have capacitated ordinary people all round the world to become human rights activists. Since it is now easy and cheap to do, millions of people are now recording events and posting them on social media. This has become a preventative tool, as well as an accountability device.

Science and technology can thus help to understand the what, who, how, when and where of human rights violations, to reveal the truth about past events and to bring the truth to more people more often. The issue is now improving how those doing the investigations collect and use this information for trial purposes and other official ends. This has not been done very well until now. More political will to investigate human rights cases needs to be shown, as well as a commitment to use the information for accountability and truth enhancement purposes.

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