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The Challenging Power of Data Visualization for Human Rights Advocacy

John Emerson, Margaret L. Satterthwaite, and Anshul Vikram Pandey

I INTRODUCTION

In September 2007, *The New York Times* columnist Nicholas Kristof traveled with Bill Gates to Africa to look at the work the Bill & Melinda Gates Foundation was doing to fight AIDS. In an e-mail to a *Times* graphics editor, Kristof recalls:

> while setting the trip up, it emerged that his initial interest in giving pots of money to fight disease had arisen after he and melinda read a two-part series of articles i did on third world disease in January 1997. until then, their plan had been to give money mainly to get countries wired and full of computers.
>
> bill and melinda recently reread those pieces, and said that it was the second piece in the series, about bad water and diarrhea killing millions of kids a year, that really got them thinking of public health. Great! I was really proud of this impact that my worldwide reporting and 3,500-word article had had. But then bill confessed that actually it wasn't the article itself that had grabbed him so much – it was the graphic. It was just a two column, inside graphic, very simple, listing third world health problems and how many people they kill. but he remembered it after all those years and said that it was the single thing that got him redirected toward public health.
>
> No graphic in human history has saved so many lives in africa and asia.[1]

Kristof's anecdote illustrates the sometimes unexpected power of data visualization: Expressing quantitative information with visuals can lend urgency to messages and make stories more memorable.

Data visualization is the "visual representation of 'data,' defined as information which has been abstracted in some schematic form."[2] The use of data visualization

[1] "Talk to the Newsroom: Graphics Director Steve Duenes," *The New York Times*, February 28, 2008, www.nytimes.com/2008/02/25/business/media/25asktheeditors.html.

[2] M. Friendly and D. J. Denis, "Milestones in the history of thematic cartography, statistical graphics, and data visualization," August 24, 2009, www.math.yorku.ca/SCS/Gallery/milestone/milestone.pdf.

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can strengthen human rights work when data is involved, and it does something for the promotion of human rights that other methods don't do. Combining data and visuals allows advocates to harness the power of both statistics and narrative. Data visualization can facilitate understanding and ultimately motivate action. And within human rights research, it can help investigators and researchers draw a bigger picture from individual human rights abuses by allowing them to identify patterns that may suggest the existence of abusive policies, unlawful orders, negligence, or other forms of culpable action or inaction by decision-makers. As human rights researchers and advocates look for new ways to understand the dynamics behind human rights violations, get their messages across, and persuade target audiences, they are also expanding the epistemology of advocacy-oriented human rights research. By broadening their evidence base and using new methods, human rights advocates come to know different things – and to know the same things differently.

The use of data visualization and other visual features for human rights communication and advocacy is a growing trend. A study by New York University's Center for Human Rights and Global Justice reviewing all Human Rights Watch (HRW) and Amnesty International reports published in 2006, 2010, and 2014 revealed an increase in the use of photographs, satellite imagery, maps, charts, and graphs.[3] In some cases, data visuals augment existing research and communications methodologies; in other cases, they represent alternative and even novel tools and analytical methods for human rights NGOs.

While data visualization is a powerful tool for communication, the use of data and visualization holds exciting promise as a method of knowledge production. Human rights researchers and advocates are adding new methodologies to their toolbox, drawing on emerging technologies as well as established data analysis techniques to enhance and expand their research, communications, and advocacy. This chapter introduces ways data visualization can be used for human rights analysis, advocacy, and mobilization, and discusses some of the potential benefits and pitfalls of using data visualization in human rights work. After a brief historical review of data visualization for advocacy, we consider recent developments in the "datafication" of human rights, followed by an examination of some assumptions behind, and perils in, visualizing data for human rights advocacy. The goal of this chapter is to provide sufficient grounding for human rights researchers to engage with data visualization in a way that is as powerful, ethical, and rights-enhancing as possible.

II A BRIEF HISTORY OF STATISTICAL GRAPHICS AND ADVOCACY

Visual storytelling has a long and colorful history. Past generations not only created depictions of their reality, but also crafted visual explanations and diagrams to

[3] K. Rall, "Data Visualization for Human Rights Advocacy" (2016) 8 *Journal of Human Rights Practice* 171–97.

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convey and understand the invisible forces governing the visible world and other realms beyond perception. In *The Book of Trees: Visualizing Branches of Knowledge*, Manuel Lima charts the use of the branching tree as a visual metaphor in charts from Mesopotamia to medieval Europe to the present.[4] In addition to visual storytelling, ancient civilizations developed visual methods to record, understand, and process large numbers. The ancient Babylonians, Egyptians, Greeks, and Chinese used visual systems to record data about vital resources, chart the stars, and map their territories.[5] While visual storytelling was intended for communication, data visualization was used by the ruling powers to interpret and keep tabs on their empires.[6]

Along with the development of modern statistics in the late eighteenth century, there emerged graphical methods of quantitative analysis – new kinds of charts and graphs to visually show patterns in data.[7] The Scottish political economist William Playfair was a mechanical engineer, statistician, and activist who authored essays and pamphlets on the politics of the day and helped storm the Bastille in Paris in 1787.[8] That same year, he published the kind of line, area, and bar charts that we routinely use today for the first time in his *Commercial and Political Atlas*[9] to display imports and exports between Scotland and other countries and territories. He published the first modern pie chart in his 1801 *Statistical Breviary*.[10]

In the first half of the nineteenth century, new technologies helped spread and inspire enthusiasm for both statistics and data visualization.[11] Commercial mechanical devices for counting, sorting, and calculating became popular, and the first successful mass-produced mechanical calculator was launched in 1820.[12] Printing technology, particularly lithography and chromolithography, enabled a more

[4] M. Lima, *The Book of Trees: Visualizing Branches of Knowledge* (New York: Princeton Architectural Press, 2014).

[5] F. Cajori, *A History of Mathematical Notations* (Mineola, NY: Dover Publications, 1928), pp. 2–18, 21–29, 43–44; *see also History of Cartography* (Chicago: University of Chicago Press, 1997), vol. 1, pp. 107–147, vol. 2, pp. 96–127.

[6] J. C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven, CT: Yale University Press, 1998), pp. 2–52.

[7] M. Friendly, "The Golden Age of Statistical Graphics" (2008) 23 *Institute of Mathematical Statistics in Statistical Science* 502–35.

[8] I. Spence and H. Wainer, "Who Was Playfair" (1997) 10(1) *Chance* 35–37.

[9] W. Playfair, *The Commercial and Political Atlas: Representing, by Means of Stained Copper-Plate Charts, the Progress of the Commerce, Revenues, Expenditure and Debts of England during the Whole of the Eighteenth Century*, 3rd ed. (New York: Cambridge University Press, 2005).

[10] W. Playfair, *Statistical Breviary; Shewing, on a Principle Entirely New, the Resources of Every State and Kingdom in Europe* (London: Wallis, 1801). For more on Playfair's development of the pie chart, see I. Spence, "No Humble Pie: The Origins and Usage of a Statistical Chart" (2005) 30 *Journal of Educational and Behavioral Statistics* 353–68.

[11] M. Friendly, "The Golden Age of Statistical Graphics" (2008) 23 *Institute of Mathematical Statistics in Statistical Science* 502–35.

[12] P. A. Kidwell, "American Scientists and Calculating Machines – From Novelty to Commonplace" (1990) 12 *IEEE Annals of the History of Computing* 31–40.

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expressive range of printing. The Statistical Society of London was founded in 1834 and, by royal charter, became the Royal Statistical Society in 1887.[13] As the psychology scholar Michael Friendly notes, between 1850 and 1900, there was explosive growth in both the use of data visualization and the range of topics to which it was applied.[14] In addition to population and economic statistics, mid-nineteenth-century Paris saw the publication of medical and mortality statistics, demographics, and criminal justice data.[15]

A few examples from this period show how data visualization contributed new findings using spatial and other forms of analysis, and allowed such findings to be made meaningful to a broader public via visual display.

In 1854, Dr. John Snow mapped cholera deaths around the thirteen public wells accessed in the Soho district of London.[16] Using this method, he made a dramatic discovery: there was a particular cluster of deaths around one water pump on Broad Street. His findings ran contrary to the prevailing theories of disease. At the time, the medical establishment believed in the miasma theory, which held that cholera and other diseases, such as chlamydia and the Black Death, were caused by "bad air." Dr. Snow believed that cholera was spread from person to person through polluted food and water – a predecessor to the germ theory of disease. Despite skepticism from the medical establishment, Snow used his map to convince the governing council to remove the handle from the pump, and the outbreak quickly subsided.[17]

Florence Nightingale is known primarily as one of the founders of modern nursing, but she was also a statistician who used data visualization to campaign for improvements in British military medicine.[18] In 1858, she popularized a type of pie chart known as the polar area diagram.[19] The diagram divides a circle into wedges that extend at different lengths from the center to depict magnitude. Nightingale used statistical graphics in her reports to members of Parliament about the condition of medical care in the Crimean War to illustrate how improvements in hygiene could save lives: at a glance, one could see that far more soldiers died of sickness

[13] I. D. Hill, "Statistical Society of London – Royal Statistical Society: The First 100 Years: 1834–1934" (1984) 147 *Journal of the Royal Statistical Society. Series A (General)* 130–39 at 131, 137.

[14] *See* Friendly, "The Golden Age" at 502.

[15] *See* ibid.

[16] For an extensive discussion of Dr. Snow's advances in graphical reasoning, see E. R. Tufte, *Visual Explanations: Images and Quantities, Evidence and Narrative* (Cheshire, CT: Graphics Press, 1997) pp. 27–37.

[17] The map also shows notable outliers: there were no cholera deaths reported at the neighboring brewery, where, presumably, there were other things to drink. *See* E. Tufte, *The Visual Display of Quantitative Information*, 2nd ed. (Cheshire, CT: Graphics Press, 2001), p. 30.

[18] I. B. Cohen, "Florence Nightingale" (1984) 250 *Scientific American* 128–37.

[19] S. Rogers, "Florence Nightingale, datajournalist: Information has always been beautiful," *The Guardian*, August 13, 2010, www.theguardian.com/news/datablog/2010/aug/13/florence-nightingale-graphics.

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than of wounds sustained in battle.[20] Nightingale persuaded Queen Victoria to appoint a Royal Commission on the Health of the Army, and her advocacy, reports, and the work of the commission eventually led to systemic changes in the design and practices of UK hospitals.[21]

After a long and distinguished career as a civil engineer in France, Charles Minard devoted himself in 1851 to research illustrated with graphic tables and figurative maps.[22] His 1869 visualization of Napoleon's 1812 Russian Campaign shows the march of the French army from the Polish-Russian border toward Moscow and back.[23] The chart was heralded by Minard's contemporaries and is held up by twentieth-century data visualization critics as a marvel of clarity and data density. The visualization displays six different dimensions within the same graphic: The thickness of the main line shows the number of Napoleon's troops; the scale of the line shows the distance traveled; rivers are depicted and cities are labeled; dates indicate the progress of the march relative to specific dates; the orientation of the line shows the direction of travel; and a line chart below the route tracks temperature. Reading the map from left to right and back again, another message beyond the data emerges: As the march proceeds and retreats, the horrific toll of the campaign slowly reveals itself as the troop numbers decline dramatically. The graphic not only details historical fact, but serves as a powerful antiwar statement.

In the United States, data visualization was used to sound the alarm on the frequency of racist violence and its consequences. In 1883, the *Chicago Tribune* began publishing annual data on lynching in the form of a monthly calendar listing victims by date.[24] The journalist and anti-lynching campaigner Ida B. Wells cited the data in her speeches and articles. The annual publication of state and national statistics fed the public's outrage, and on September 1, 1901, the *Sunday Tribune* published a full front-page table of data on 3,000 lynchings committed over 20 years, as well as information about the victims of 101 lynchings perpetrated in 1901 and the allegations against the victims that their killers had cited to rationalize the violence.[25] Rather than focusing on individual cases, the data, table, and narrative exploration presented a powerful picture of the frequency and scale of the crisis: though lynchings occurred in mostly southern states, they were found in nearly every state of the union. The pages appeal to public opinion to support

[20] Cohen, "Florence Nightingale," at 132.

[21] Ibid.

[22] V. Chevallier, "Notice nécrologique sur M. Minard, inspecteur général des ponts et chaussées, en retraite" (1871) 2 *Annales des ponts et chaussées* 1–22 (translated by D. Finley at www.edwardtufte.com/tufte/minard-obit).

[23] For an extensive discussion of C. Minard's "space-time-story graphics," see Tufte, *Visual Display*, pp. 40–41.

[24] L. D. Cook, "Converging to a National Lynching Database: Recent Developments and the Way Forward" (2012) 45 *Historical Methods: A Journal of Quantitative and Interdisciplinary History* 55–63 at 56.

[25] Ibid.

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change, explicitly calling out the failure of state and local law enforcement and demanding congressional action.

These historic charts and graphs are analytical, but also rhetorical, using visual conventions to identify the dynamics of important phenomena and to communicate findings and make an argument and a persuasive case for policy change. We will investigate some of the promises and pitfalls of coupling visual rhetoric with data below, but first we briefly examine datafication and human rights.

III DATAFICATION AND HUMAN RIGHTS

As a field, advocacy-oriented human rights research traditionally favors qualitative over quantitative research methodologies. Research is typically driven by interviews with victims, witnesses, and alleged perpetrators, usually supplemented by official documents, secondary sources, and media accounts.[26] Additional qualitative methods, including focus groups and participatory observation, are used by some groups, as are forensic methods such as ballistics, crime scene investigations, and exhumations. Quantitative methods such as data analysis and econometrics have been very rare until recently. There are many reasons for the traditional emphasis on qualitative methods. Historically, advocacy-oriented human rights research developed out of legal and journalistic traditions.[27] Ethically, rights advocates are committed to the individual human story. Human rights practice has been defined as "the craft of bringing together legal norms and human stories in the service of justice."[28]

At the same time, researchers in social science, epidemiology, and other fields have long used quantitative methods for research on human rights related issues. Political scientists have developed cross-national time-series datasets to interrogate the relationships between human rights and major social, economic, and political processes.[29] Epidemiologists have studied inequalities in access to health care and disparities in health outcomes between social groups.[30] Research psychologists have

[26] M. Langford and S. Fukuda-Parr, "The Turn to Metrics" (2012) 30 *Nordic Journal of Human Rights*, 222–38 at 222.

[27] M. L. Satterthwaite and J. Simeone, "A Conceptual Roadmap for Social Science Methods in Human Rights Fact-Finding," in P. Alston and S. Knuckey (eds.), *The Transformation of Human Rights Fact-Finding* (New York: Oxford University Press, 2016), p. 323.

[28] P. Gready, "Introduction – Responsibility to the Story" (2010) 2 *Journal of Human Rights Practice* 177–90 at 178.

[29] For an examination of several such data sets, *see* M. L. Satterthwaite, "Coding Personal Integrity Rights: Assessing Standards-Based Measures Against Human Rights Law and Practice" (2016) 48 *New York University Journal of International Law and Politics* 513–79.

[30] O. F. Norheim and S. Gloppen, "Litigating for Medicines: How Can We Assess Impact on Health Outcomes?," in A. E. Yamin and S. Gloppen (eds.), *Litigating Health Rights: Can Courts Bring More Justice to Health?* (Cambridge, MA: Harvard University Press, 2011), pp. 306–07.

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examined the way human psychology may limit our ability to respond to widespread suffering such as that arising from genocide and mass displacement.[31]

Human rights NGOs are increasingly embracing scientifically based methods of research that involve data and quantification, and they are beginning to use data visualization to reach broader audiences. Using data-driven methods from other fields enables different ways of knowing, of gathering and processing information, and of analyzing findings.

The spread of digital network infrastructure, increased computing speeds, and a decrease in the cost of digital storage have made collecting, sharing, and saving data easy and prevalent. The economic accessibility of mobile technology has made cell phones widely available, even in poor countries.[32] Smartphones have put Internet access and the production of digital content in the hands of the people – generating an enormous swarm of digital exhaust and big data about many populations across the world. This explosion of new data reflects a democratization of sorts, but it also puts a new means of surveillance at the command of state agents,[33] increases the power of private data owners and brokers, and creates pockets of digital exclusion, where communities that do not benefit from the digital revolution are further marginalized.

In this "datified" world, decision-makers seek evidence in the form of data and quantitative analysis. As Sally Merry notes, "quantitative measures promise to provide accurate information that allows policy makers, investors, government officials, and the general public to make informed decisions. The information appears to be objective, scientific, and transparent."[34] While Merry's language suggests that numbers themselves promise to smooth over the messiness of decision-making by appearing scientific, it is, of course, human beings who insist on quantification. Theodore Porter has identified quantification as a "technology of distance" capable of mediating distrust, such as that between governments and citizens.[35] In the human rights context, quantification sometimes functions as a way of disappearing the judgment-laden practices of monitoring and assessment, where governments

[31] *See, e.g.*, P. Slovic and D. Zionts, "Can International Law Stop Genocide When Our Moral Intuitions Fail Us?," in R. Goodman, J. Derek, and A. K. Woods (eds.), *Understanding Social Action, Promoting Human Rights* (New York: Oxford University Press, 2012), pp. 100–28.

[32] Globally, the number of mobile cell phone subscriptions reached 97 per 100 people in 2014. Serious inequality remains, with only 56 per 100 in low-income, 96 per 100 in middle-income, and 122 per 100 in high-income countries. *See* International Telecommunication Union, World Telecommunication/ICT Development Report and database, "Mobile cellular subscriptions (per 100 people," http://data.worldbank.org/indicator/IT.CEL.SETS.P2.

[33] As Mark Latonero writes, "The very same tools, techniques, and processes in the collection and use of big data can be employed to both violate and protect human rights." M. Latonero, "Big Data Analytics and Human Rights: Privacy Considerations in Context," Chapter 7.

[34] S. E. Merry, *The Seductions of Quantification: Measuring Human Rights, Gender Violence, and Sex Trafficking* (Chicago and London: University of Chicago Press, 2016), p. 3.

[35] M. Power, *The Audit Society: Rituals of Verification* (Oxford: Oxford University Press, 1997), pp. 4–5.

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may distrust their monitors as much as monitors distrust officials.[36] In such a context, knowing how many were killed, assaulted, or detained can be seen to satisfy a yearning for objective knowledge in a chaotic and often brutal world.

Metrics are also attractive because they can be weighed against other data and wrapped up into "indicators." Kevin Davis, Benedict Kingsbury, and Sally Merry define indicators as:

> a named collection of rank-ordered data that purports to represent the past or projected performance of different units. The data are generated through a process that simplifies raw data about a complex social phenomenon. The data, in this simplified and processed form, are capable of being used to compare particular units of analysis (such as countries or institutions or corporations), synchronically or over time, and to evaluate their performance by reference to one or more standards.[37]

In the human rights realm, indicators have been developed, *inter alia*, to directly measure human rights violations,[38] assess compliance with treaty norms,[39] measure the impacts of company activities on human rights,[40] and ensure that development processes and humanitarian aid are delivered in a rights-respecting manner.[41] As Merry notes in *The Seductions of Quantification*, indicators are attractive in their simplicity, particularly country rankings that have proven effective in catching the attention of the media and the public.[42] While indicators provide a convenient analysis at a glance, they are complicated and often problematic: Data collected may be incomplete or biased, not comparable between countries, or compromised by encompassing metrics of behavior that may not capture a diversity of values or reasons for the behavior.[43] There may also be a slippage between the norm and

[36] For a discussion of this dynamic, *see* M. L. Satterthwaite and A. Rosga, "The Trust in Indicators: Measuring Human Rights" (2009) 27 *Berkeley Journal of International Law* 253–315 at 253.

[37] K. E. Davis, B. Kingsbury, and S. E. Merry, "Indicators as a Technology of Global Governance" (2012) 46(1) *Law & Society Review* 71–104 at 73–74.

[38] E. Witchel, "Getting Away with Murder: CPJ's 2015 Global Impunity Index spotlights countries where journalists are slain and the killers go free," Committee to Protect Journalists, October 8, 2015.

[39] Office of the United Nations High Commissioner for Human Rights, *Human Rights Indicators, a Guide to Measurement and Implementation* (New York: United Nations, 2012).

[40] D. de Felice, "Business and Human Rights Indicators to Measure the Corporate Responsibility to Respect: Challenges and Opportunities" (2015) 37 *Human Rights Quarterly* 511–55.

[41] For development processes, see T. Landman et al., *Indicators for Human Rights Based Approaches to Development in UNDP Programming: A User's Guide* (New York: United Nations Development Programme, 2006). For a discussion of rights-based indicators for humanitarian aid, see M. L. Satterthwaite, "Indicators in Crisis: Rights-Based Humanitarian Indicators in Post-Earthquake Haiti" (2012) 43(4) *New York University Journal of International Law and Politics* 865–965.

[42] S. E. Merry, *The Seductions of Quantification: Measuring Human Rights, Gender Violence, and Sex Trafficking* (Chicago and London: University of Chicago Press, 2016), p. 16.

[43] Ibid.

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the data used to assess the norm, a dynamic in which difficult-to-measure phenomena are assessed using proxy indicators that may become attenuated from the original norm.

In the human rights field, the relationship between the norm and the data can be especially complicated. Human rights data is almost always incomplete and often fraught with bias and assumptions.[44] The imperfect nature of human rights data is a consequence of the challenges facing its collection. There are inherent difficulties in getting a complete or unbiased dataset of anything, but it is particularly challenging when it is in a government's self-interest to hide abuses and obstruct accountability. Marginalized groups may be excluded from the available information as a result of implicit bias, or even by design.[45] For human rights researchers, there may be dangers and difficulties associated with asking certain questions or accessing certain information. Much of the data gathered about civil and political rights violations is collected through case reports by human rights organizations, making it inherently biased by factors such as the organization's familiarity and accessibility, the victims' willingness to report, and the security situation.[46] Data about economic and social rights may seem easier to gather, since there is a plethora of official data in most countries about education, housing, water, and other core rights. This data is not designed to assess rights, however, meaning that it is, at best, proxy data for rights fulfillment.[47]

However, even when there are flaws in the data collection or the data itself, the results can sometimes be useful to researchers and rights advocates. For instance, if the methodology for gathering data is consistent year after year, one may be able to draw certain types of conclusions about trends in respect for rights over time even absent a representative sample. If the data in question was collected by a government agency, it can be strategic for activists to lobby the government using its own data despite the flaws it contains, since such a strategy makes the conclusions that much harder to refute.

Further, a great power of statistics is the ability to work with data that is incomplete, biased, and uncertain – and to quantify bias and uncertainty with some measure of precision. Patrick Ball, Megan Price, and their colleagues at the Human Rights Data Analysis Group have pioneered the application of multiple systems estimation and other statistical methods to work with limited data in post-conflict

[44] M. Price and P. Ball, "Big Data, Selection Bias, and the Statistical Patterns of Mortality in Conflict" (2014) 34 (1) *The SAIS Review of International Affairs* 9–20.

[45] For instance, see P. Heijmans, "Myanmar criticised for excluding Rohingyas from Census," *Al Jazeera*, May 29, 2015, www.aljazeera.com/news/2015/05/myanmar-criticised-excluding-rohingyas-census-150529045829329.html.

[46] Brian Root lists other biases affecting human rights data collection in "Numbers Are Only Human," in Alston and Knuckey (eds.), *The Transformation of Human Rights Fact-Finding*, p. 363.

[47] S. McInerney-Lankford and H. Sano, *Human Rights Indicators in Development: An Introduction* (Washington, DC: World Bank Publications, 2010), pp. 16–17.

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and ongoing conflict zones.[48] The group is often asked to evaluate or correct traditional casualty counts using their experience with statistical inferences.[49] They have contributed data analysis to both national and international criminal tribunals and truth commissions.

IV CHALLENGES OF DATA

Data is always an abstraction – a representation of an idea or phenomenon. Data is also a product of its collection method, whether it is a recording of a signal, survey, mechanical trace, or digital log. As the scholar Laura Kurgan explains:

> There is no such thing as raw data. Data are always translated such that they might be presented. The images, lists, graphs, and maps that represent those data are all interpretations. And there is no such thing as neutral data. Data are always collected for a specific purpose, by a combination of people, technology, money, commerce, and government. The phrase "data visualization" in that sense, is a bit redundant: data are already a visualization.[50]

Analysts may try to use algorithms and data to limit human bias and preconceptions in decision-making. However, researchers can't help but cast a human shadow on facts and figures; data is affected by people's choices about what to collect, when and how it is collected, even who is doing the collecting. Human rights researchers have begun to call attention to these hidden aspects of data gathering and analysis, examining the rights implications of their elision, and the perils and promise in their use.

For example, data-driven policing based on computerized analyses of arrest and crime data has been advanced as a method for making law enforcement less prone to bias.[51] However, the use of algorithms and visualization in such "predictive policing" often amplifies existing assumptions and historical patterns of prejudice and discrimination, driving police to increase scrutiny of already over-policed neighborhoods.[52] A human rights critique is needed to assess the use of algorithms in predictive policing as well as other practices, like the use of computer scoring to recommend

[48] See, for instance, P. Ball et al., "The Bosnian Book of the Dead: Assessment of the Database," Households in Conflict Network Research Design (2007), and M. Price et al., "Full Updated Statistical Analysis of Documentation of Killings in the Syrian Arab Republic," Human Rights Data Analysis Group (2013).

[49] P. Ball, et al. "How Many Peruvians Have Died? An Estimate of the Total Number of Victims Killed or Disappeared in the Armed Internal Conflict between 1980 and 2000," American Association for the Advancement of Science, August 28, 2003.

[50] L. Kurgan, "Representation and the Necessity of Interpretation," *Close Up at a Distance: Mapping, Technology, and Politics* (New York: Zone Books, 2013), p. 35.

[51] A. G. Ferguson, "Policing Predictive Policing" (forthcoming) 94 *Washington University Law Review*.

[52] K. Lum and W. Isaac, "To predict and serve?" (2016) 13 *Significance* 14–19 at 16.

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sentencing ranges in overcrowded justice systems.[53] Techniques developed in the algorithmic accountability movement are especially useful here: Audits and reverse engineering can uncover hidden bias and discrimination,[54] which could be assessed against human rights norms.

Metadata describes the origin story of data: the time and place it was created, its sender and receiver, the phone used, network used, IP address, or type of camera. As former US National Security Agency General Counsel Stewart Baker hauntingly put it, "Metadata absolutely tells you everything about somebody's life. If you have enough metadata, you don't really need content."[55] Outside the domain of state security or intelligence, metadata can be useful to human rights researchers and activists as well, for instance, to counter claims that incriminating images or video recordings were falsified or to corroborate that a set of photos were taken in the same place, on the same day, by the same camera. Amnesty International used metadata from photos and videos to corroborate attacks on suspected Boko Haram supporters by Nigerian soldiers, thereby implicating them in war crimes.[56] Building on its experience training grassroots activists to use video for advocacy, the NGO WITNESS worked with the Guardian Project to develop a mobile application called CameraV to help citizen journalists and human rights activists manage the digital media and metadata on their smartphones by automatically encrypting and transmitting media files to a secure server, or, conversely, by deleting and obscuring the metadata when it could put activists at risk.[57]

In addition to concerns about accuracy, rights groups should be cautious in their approach to privacy and ownership of data, and to its analysis and expression through visualization. Over the years, researchers and lawyers have developed a set of best practices to guide the proper collection and use of data, with particular attention to human subjects research.[58] Questions related to the collection of data go to the heart

[53] On June 29, 2016, the ACLU filed a lawsuit on behalf of a group of academic researchers, computer scientists, and journalists challenging the US Computer Fraud and Abuse Act. The law creates significant barriers to research and testing necessary to uncover discrimination in computer algorithms. *See* E. Bhandari and R. Goodman, "ACLU Challenges Computer Crimes Law That Is Thwarting Research on Discrimination Online," American Civil Liberties Union, June 29, 2016, www.aclu.org/blog/free-future/aclu-challenges-computer-crimes-law-thwarting-research-discrimination-online.

[54] *See, e.g.*, C. Sandvig et al., "Auditing Algorithms: Research Methods for Detecting Discrimination on Internet Platforms," presentation at the 64th Annual Meeting of the International Communication Association, Seattle, WA, May 24–26, 2014.

[55] A. Rusbriger, "The Snowden Leaks and the Public," *The New York Review of Books*, November 21, 2013, www.nybooks.com/articles/2013/11/21/snowden-leaks-and-public/.

[56] C. Koettl, "Chapter 7: Using UGC in human rights and war crimes investigations," *Verification Handbook for Investigative Reporting* (Maastricht, the Netherlands: European Journalism Centre, 2015), pp. 46–49.

[57] WITNESS, "Is This for Real? How InformaCam Improves Verification of Mobile Media Files," WITNESS, January 15, 2013, https://blog.witness.org/2013/01/how-informacam-improves-verification-of-mobile-media-files/.

[58] See, for instance, US Department of Health and Human Services Office for Human Research Protections, Informed Consent Checklist (1998), www.hhs.gov/ohrp/regulations-and-policy/

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of what constitutes ethical research methods: Did the subjects give informed consent regarding the way their personal data would be used? Does using, collecting, or publishing this data put anyone at risk? Is the data appropriately protected or anonymized? The rules about data continue to evolve and are not without gray areas and open questions. Universities in the United States and many other countries have review processes in place to provide guidance and ensure that critical ethical questions are raised before research is approved. In fact, these ethical questions and review processes are required under US law for research institutions that receive federal funding. However, the "common rule" underlying these processes is widely seen as out of date when it comes to data ethics – especially big data ethics.[59] Ethical discussions and guidelines about data visualization are almost nonexistent, with a 2016 Responsible Data Forum on the topic a very welcome outlier.[60] The forum brought together academics, activists, and visualization practitioners to discuss issues such as the ethical obligation to ensure that data is responsibly collected and stored before being visualized; representing bias, uncertainty, and ambiguity in data visualization; and the role of empathy and data visualization in social change.[61]

V VISUALIZING QUANTITATIVE DATA

With data and data visualizations, physical phenomena like the impact of disease and the movement of troops can become legible – as can systems like economies, relationships, and networks of power. Using data to examine policies, populations, actions, and outcomes over time, individual cases can be seen as instances of widespread and systematic patterns of abuse. However, possession of data does not constitute knowledge. Data requires interpretation, context, and framing. Graphics are a powerful way to help contextualize and frame data, present interpretations, and develop understanding. Through visualization and analysis, correlations and

guidance/checklists/index.html, and UK Information Commissioner's Office, Code of Practice on Anonymisation (2012), https://ico.org.uk/for-organisations/guide-to-data-protection/anonymisation/.

[59] A lively debate is currently under way concerning revisions to the Common Rule and federal regulations, with an especially relevant part of that debate centered on ethics in big data research. *See* J. Metcalf, E. F. Keller, and D. Boyd, "Perspectives on Big Data, Ethics, and Society," The Council for Big Data, Ethics, and Society, May 23, 2016, http://bdes.datasociety.net/wp-content/uploads/2016/05/Perspectives-on-Big-Data.pdf; J. Metcalf and K. Crawford, "Where Are Human Subjects in Big Data Research? The Emerging Ethics Divide" (2016) *Big Data & Society* 1–14.

[60] *See* "Responsible Data Forum: Visualization," *Responsible Data Forum*, January 15, 2016, https://responsibledata.io/forums/data-visualization/; *see also* F. Neuhaus and T. Webmoor, "Agile Ethics for Massified Research and Visualization. Information" (2013) 15 *Communication & Society* pp. 43–65.

[61] For more details about the discussion, see M. Stempeck, "DataViz for good: How to ethically communicate data in a visual manner: #RDFviz," Microsoft New York, January 20, 2016, https://blogs.microsoft.com/newyork/2016/01/20/dataviz-for-good-how-to-ethically-communicate-data-in-a-visual-manner-rdfviz/.

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patterns of structural violence and discrimination as well as the scope or systemic nature of abuses can become clear.

Data visualization is useful not only for explaining patterns in a dataset, but also for discovering patterns. For its 2011 report *A Costly Move*, HRW used mapping tools to visualize and analyze patterns in a large dataset of more than five million records concerning the transfer of immigrant detainees around the United States.[62] Analyzing twelve years of data, the group found that detainees were transferred repeatedly, often to remote detention centers, a process that impeded their right to fair immigration proceedings. In 2000, HRW and the American Association for the Advancement of Science visualized statistical analyses of extrajudicial executions and refugee flows from Kosovo to Albania in 1999. Instead of random violence, they found distinct surges of activity that suggested purposeful, planned, and coordinated attacks by government forces.[63]

Data is particularly useful to those seeking to understand structural, systemic violations such as abuses of economic, social, and cultural rights. Taking data from development surveys, activists have used data visualization to compare trends in health,[64] education,[65] housing,[66] and other areas against government budgets, tax revenues, and other economic data to paint a picture of progressive realization of rights against "maximum available resources," as outlined in the International Covenant on Economic, Social, and Cultural Rights.[67]

Within the context of communications and advocacy, one powerful characteristic of data visualization is that it is perceived as scientific. In one study, Aner Tal and Brian Wasnick found that including visual elements associated with science, such as graphs, can enhance a message's persuasiveness.[68] Our research group at New York University also found that when viewers did not already hold strong opinions against the subject matter, graphics presented in diagrams or charts were more persuasive than the same information presented in a table.[69] In another study, on people's

[62] B. Root, "Data Analysis for Human Rights Advocacy," School of Data, November 23, 2013, https://schoolofdata.org/author/broot/.

[63] Human Rights Watch, "Chapter 15: Statistical Analysis of Violations," in *Under Orders: War Crimes in Kosovo* (New York: Human Rights Watch, 2001), pp. 345–68.

[64] Center for Economic and Social Rights (CESR), "Visualizing Rights: Guatemala Fact Sheet" (2008), www.cesr.org/sites/default/files/Guatemala_Fact_Sheet.pdf.

[65] Ibid.

[66] CESR, "Visualizing Rights: Cambodia Fact Sheet" (2009), www.cesr.org/sites/default/files/cambodia_WEB_CESR_FINAL.pdf.

[67] A. Corkey, S. Way, and V. Wisniewiki Otero, *The OPERA Framework: Assessing Compliance with the Obligation to Fulfill Economic, Social and Cultural Rights* (Brooklyn, NY: Center for Economic and Social Rights, 2012), p. 30.

[68] A. Tal and B. Wansink, "Blinded with Science: Trivial Graphs and Formulas Increase Ad Persuasiveness and Belief in Product Efficacy" (2014) 25 *Public Understanding of Science* 117–25.

[69] A. V. Pandey et al., "How Deceptive Are Deceptive Visualizations?: An Empirical Analysis of Common Distortion Techniques," presentation at the 33rd Annual ACM Conference on Human Factors in Computing Systems, Seoul, Republic of Korea, April 18–23, 2015).

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ability to remember visualizations, Michelle Borkin and colleagues found that specific visual elements of a given presentation affected its memorability. Memorable graphics had a main visual focus, recognizable objects, and clear titles and annotations.[70]

The persuasive power of charts and graphs may come at a cost: In a report full of text, numbers crucial to making a rights case are a prime target for attack and dispute.[71] The currency of human rights work is credibility, and researchers and program staff at human rights organizations carry the additional burden of having to take special care to protect their credibility and the incontrovertibility of the evidence they present. If a number in a report is convincingly challenged, the rest of the report may be called into question. Charts and numbers are also easily taken out of context, with readers understanding representations of data as statements of fact. This is all the more reason to interrogate the methodology and unpack conditions of production of specific datasets before they are used in visualizations. The powerful impact and memorability of data visualization come with a responsibility to put this knowledge to use with care and attention to the potential ethical pitfalls.

Effective data visualization can make findings clear and compelling at a glance. It provides readers with an interface to navigate great quantities of data without having to drill down into the various data points. This can obscure the fact that visualization is only a part of working with data – and often only a small part. The lead-up to the creation of a data visualization can be the key to its usefulness. Acquiring, cleaning, preparing, and analyzing data very often make up the bulk of the work. When exploring a visualization, the sometimes tedious and decidedly unsexy data work that has been done behind the scenes is not always immediately visible. And given its persuasive power, data visualization in polished and final form may gloss over issues with data collection or analysis. This may be especially true with human rights visualization, where analysis includes normative judgments about the fit between a given dataset and the legal standards at issue.

As noted above, the data used in visualization is subject to bias and the underlying assumptions around data collection and processing. In addition to this, the presentation and design of visualization is also susceptible to distortion and misinterpretation. In a series of experiments performed by our research group at NYU, empirical analysis of common distortion techniques found that these techniques did indeed mislead viewers. Distortion techniques include using a truncated y-axis (starting at a number greater than zero when illustrating percentages) or using area to represent

[70] M. A. Borkin et al., "Beyond Memorability: Visualization Recognition and Recall" (2016) 22 *IEEE Transactions on Visualization and Computer Graphics* 519–28.

[71] B. Root, "Numbers Are Only Human: Lessons for Human Rights Practitioners from the Quantitative Literacy Movement," in Alston and Knuckey (eds.), *The Transformation of Human Rights Fact-Finding* (referring to a 196-page report on sexual assault in Washington, DC; roughly five pages of statistical analysis bore the brunt of the negative criticism).

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quantity (such as comparing areas of circles.)[72] While manipulation of the facts or deception of the reader is usually unintentional in the human rights realm, accidentally misleading visualizations can affect the clarity of the message and could damage advocacy efforts.[73] As data and visualization command attention, they can also become the focus of criticism. If a misleading visualization is called to account, it could distract from the credibility of the rest of a given project's research and advocacy, and perhaps even damage the reputation of the organization.

These risks must be borne in mind as advocates have the opportunity to analyze and visualize the increasing quantities of data made available online as a result of open government efforts. While the call for open sharing of scientific data long predates the Internet, connectivity has spurred an explosion in the use, production, and demand for high-quality data, particularly data collected by government agencies. Governments are sharing great quantities of data online, and making them accessible via Freedom of Information or other "sunshine" requests. Open government data has been used to uncover and analyze patterns of human rights abuse in criminal justice data,[74] inequalities in wage data,[75] unequal burdens of pollution,[76] and the impacts of climate change in environmental data.[77] Data created to track human development, like that collected by international demographic and health surveys, has proven to be fruitful for human rights analysis as well.[78] Under the title "Visualizing Rights," the Center for Economic and Social Rights (CESR) has published a series of country fact sheets that use publicly available data for analysis and visualization to convey patterns of discrimination and the failure to fulfill rights obligations, e.g., the rights to health, food, and education in Guatemala,[79] or with regard to poverty, hunger, and housing in Egypt.[80] The CESR briefs are designed to

[72] Experiments have shown that people perceive position more effectively than area. A line next to another line half its length is more easily understood as *double* than are circles or squares compared with area doubled. *See* W. Cleveland and R. McGill, "Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods" (1984) 79 *Journal of the American Statistical Association* 531–54.

[73] Pandey et al., "How Deceptive are Deceptive Visualizations?"

[74] J. Fellner et al., *Nation Behind Bars: A Human Rights Solution* (New York: Human Rights Watch, 2014).

[75] P. Overberg and J. Adamy (reporting), L. T. Vo and J. Ma (interactive), A. V. Dam and S. A. Thompson (additional development), "What's Your Pay Gap?," *The Wall Street Journal*, May 17, 2016, http://graphics.wsj.com/gender-pay-gap/.

[76] S. A. Perlin, D. Wong, and K. Sexton, "Residential Proximity to Industrial Sources of Air Pollution: Interrelationships among Race, Poverty, and Age" (2001) 51 *Journal of the Air & Waste Management Association* 406–21.

[77] E. Rosten and B. Migliozzi, "What's Really Warming the World?" *Bloomberg*, June 24, 2015.

[78] E. Felner, "Closing the 'Escape Hatch': A Toolkit to Monitor the Progressive Realization of Economic, Social, and Cultural Rights" (2009) 1 *Journal of Human Rights Practice* 402–35.

[79] CESR, "Visualizing Rights: Guatemala Fact Sheet" (2008), www.cesr.org/sites/default/files/Guatemala_Fact_Sheet.pdf.

[80] CESR, "Visualizing Rights: Egypt Fact Sheet" (2013), www.cesr.org/sites/default/files/Egypt.Factsheet.web_.pdf.

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be read at a glance by a busy audience of policy officials and individuals who staff intergovernmental human rights mechanisms.

VI VISUALIZING QUALITATIVE DATA

A core output of traditional human rights research is the fact-finding report, which tends to rely on qualitative data such as the testimony of witnesses and survivors of human rights violations.[81] Visualization can provide useful context for the broader rights messages in such reports. For instance, to provide visual and spatial context for the findings presented in human rights reporting, it is not uncommon to include a timeline of events,[82] a map of the areas affected,[83] or a map of towns the researcher visited.[84]

Qualitative visualization for human rights generally falls into the category of visual storytelling. Techniques like breaking down an explanation into stages and walking the audience through these stages can elucidate the narrative, building an understanding of the sequence of events or the layers of information. Examining Amnesty International and HRW reports, the 2016 NYU study found that the use of visual features nearly tripled between 2006 and 2014, and that the majority of visual features used were qualitative.[85] For example, the study found that the number of reports using satellite images increased from one in 2006 to four in 2010 to seventeen in 2014. Most maps included in reports during this period displayed geographic information (such as places visited by researchers) and were only rarely used for quantitative display or analysis (such as displaying numbers of refugees).

Some of the changes in human rights reporting were made possible by advances in technology and newly available data. In the 1990s, Global Positioning System (GPS) and high-resolution satellite imagery became available for civilian use.[86] Since then, high-quality satellite imagery has become increasingly accessible from vendors and through free applications like Google Earth and other web-based mapping tools. Human rights groups have used GPS and

[81] M. Langford and S. Fukuda-Parr, "The Turn to Metrics" (2012) 30 *Nordic Journal of Human Rights* 222–38 at 222.

[82] A particularly elaborate interactive timeline is Human Rights Watch, "Failing Darfur, Five Years On," www.hrw.org/sites/default/files/features/darfur/fiveyearson/timeline.html.

[83] Human Rights Watch, "DR Congo: M23 Rebels Committing War Crimes," September 11, 2012, www.hrw.org/news/2012/09/11/dr-congo-m23-rebels-committing-war-crimes.

[84] See map of prisons visited in E. Ashamu, *"Prison Is Not for Me": Arbitrary Detention in South Sudan* (New York: Human Rights Watch, 2002).

[85] K. Rall et al., "Data Visualization for Human Rights Advocacy" (2016) 8 *Journal of Human Rights Practice* 171–97 at 179, 183.

[86] On GPS, see L. Kurgan, "From Military Surveillance to the Public Sphere," in *Close Up at a Distance: Mapping, Technology, and Politics* (New York: Zone Books, 2013), pp. 39–40. On satellite imagery, see C. Lavers, "The Origins of High Resolution Civilian Satellite Imaging – Part 1: An Overview," *Directions Magazine*, January 13, 2013, www.directionsmag.com/entry/the-origins-of-high-resolution-civilian-satellite-imaging-part-1-an-ov/303374.

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satellite imagery to present vivid pictures of changes brought about by events such as mass violence, secret detention, extrajudicial executions, internal displacement, forced evictions, and displacement caused by development projects.[87] Satellite imagery has proven especially powerful in showing the visual differences before and after an event.[88] It can show the creation or destruction of infrastructure by marking changes in the landscape designed to hide underground weapons development, or migrations of people by tracking changes in the contours of refugee camps. Satellite images provide local activists with a way to contextualize and document a bigger picture than can be seen from the ground, and enable human rights researchers outside of the country to survey places that are difficult or dangerous to access.[89] These techniques are especially crucial for closed states and in emergency contexts, though researchers based outside of the countries of interest should avoid relying solely on geospatial analysis, since it may not include local voices or context. Integrating local voices with satellite imagery provides both the "near" and the "far" and paints a more complete picture of the situation on the ground.[90]

Network graphs are another visual tool that can help illuminate human rights reporting and narrative. Network graphs are a special kind of visualization showing relationships between and among entities. A family tree is one simple example of a network graph. Networks relevant to human rights investigations include networks of corruption, formal and informal chains of command, the flow of resources among industries and the government agencies charged with regulating them, and relationships between military and paramilitary groups. Visualization serves as a useful shorthand, a way to illustrate complex networks that would be cumbersome to describe in text. For example, for its 2003 report on violence in the Ituri region of the Democratic Republic of Congo, HRW used a network graph to illustrate the web of training, funding, and alliances among national governments, national militaries,

[87] American Association for the Advancement of Science, Geospatial Technologies Project, www.aaas.org/page/geospatial-technology-projects. The AAAS has played a leading role in developing geospatial analysis as a human rights documentation tool.

[88] For example, see Amnesty International and Zimbabwe Lawyers for Human Rights, *Zimbabwe – Shattered Lives: The Case of Porta Farm* (London: Amnesty International, International Secretariat, 2006).

[89] The Committee for Human Rights in North Korea has published a series of reports that rely heavily on analysis of satellite images of prison camps and other sites of abuse in the Democratic People's Republic of Korea. See HRNK publications at www.hrnk.org/publications/hrnk-publications.php.

[90] Combining "near" and "far" is a powerful storytelling technique, mixing testimonies, individual stories, or data points of personal interest to the reader (the near view) with the overview of large-scale trends and data abstraction. This creates an empathetic entry point into the larger story, and locates and contextualizes it. Scott Klein touches on this a bit more in "The Design and Structure of a News Application," *ProPublica*, https://github.com/propublica/guides/blob/master/design-structure.md, as does Dominikus Baur in "The superpower of interactive datavis? A micro-macro view!," *Medium*, April 13, 2017, https://medium.com/@dominikus/the-superpower-of-interactive-datavis-a-micro-macro-view-4d027e3bdc71.

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and local paramilitary groups.[91] The graph clarifies the complicity of the national governments in local atrocities. The 2007 Global Witness report *Cambodia's Family Trees* uses a network graph to illustrate the connections and relationships among more than sixty individuals and family members, companies, the military, and government agencies in a deeply entrenched web of corruption around illegal logging.[92]

Graph theory, the study of networks and their properties, can be used to model the spread of information or influence along social networks. One of Google's early innovations was analyzing the network structure of the Internet – i.e., determining which pages are linked to from other pages – in order to rank web pages by relevance. Graph theory algorithms that weigh connections among entities to gauge their importance have proven useful to help navigate millions of pages in document dumps such as WikiLeaks and the Panama Papers. Network analysis and visualization can help make these large sets of data navigable and give researchers and the public a starting point toward understanding connections between parties. Like statistics, network analysis is a tool of social scientists that is increasingly being used by human rights researchers. As noted in Jay Aronson's chapter (Chapter 6), the Carter Center has used network analysis of social media postings by armed groups in Syria to estimate chains of command and track emerging and shifting alliances among groups.[93]

At the nexus of qualitative and quantitative analysis, Forensic Architecture is an international collaboration that is researching incidents around the world through crime scene reconstructions of human rights violations. Founded by the architect Eyal Weizman, Forensic Architecture uses diverse sources, including photos, cell phone audio and video, satellite imagery, digital mapping, and security camera and broadcast television footage, to painstakingly reconstruct the scene of a violation as a virtual three-dimensional architectural model. The team looks at traces and clues in the data sources. For instance, ascertaining the time of an incident from time stamps on digital metadata and even the fall of shadows in imagery and footage allows the team to establish a sequence of events and uncover falsifications or omissions in recordings. The reconstructions go so far as to adjust the virtual camera lens to match the parallax distortion of video, allowing for analysis of things like line of vision or the position of a munitions impact. The spatial data and architectural model become the nexus that stitch together the reconstruction to determine just what happened at a given point in time and space, how it happened, and who was responsible.[94]

[91] A. Van Woudenberg, *Covered in Blood: Ethnically Targeted Violence in Northern DRC* (New York: Human Rights Watch, 2003), p. 24.

[92] Global Witness, *Cambodia's Family Trees: Illegal Logging and the Stripping of Public Assets by Cambodia's Elite* (London: Global Witness, 2007), pp. 48–49.

[93] Carter Center, "Carter Center Makes Dynamic Syria Conflict Map Available to Public," Press Release, March 8, 2016, www.cartercenter.org/news/pr/syria-030916.html.

[94] See, for instance, Forensic Architecture's interactive report "The Killing of Nadeem Nawara and Mohammad Mahmoud Odeh Abu Daher in a Nakba Day Protest Outside of Beitunia on May 1, 2014," http://beitunia.forensic-architecture.org.

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Recent developments in machine learning have also made possible a kind of qualitative data analysis of imagery by computers: the use of computer vision algorithms to detect patterns and recognize objects depicted in digital image data. This can include faces or pictures of weapons in massive bodies of social media images, or feature detection in footage from camera-enabled drones, closed-circuit video surveillance, or satellite imagery. Applying these techniques to human rights research, the Event Labeling through Analytic Media Processing (E-LAMP) project at Carnegie Mellon University combines computer vision and machine learning for conflict monitoring by searching through large volumes of video for objects (weapons, military vehicles, buildings, etc.), actions (explosions, tank movement, gunfire, structures collapsing, etc.), written text, speech acts, human behaviors (running, crowd formation, crying, screaming, etc.), and classes of people such as soldiers, children, or corpses.[95] Project ARCADE is a prototype application that uses computer vision to analyze satellite imagery in order to automate the detection of bomb crater strikes and determine their origin.[96] In these instances, after its algorithmic processing, the source imagery is often annotated with visual indicators that are more readily interpreted by humans and the image data is made understandable through a layer of visualization. Such applications are likely to become more common in the human rights field, though, as noted above, machine learning is only as good as its input and the assumptions embedded in it.

VII TECHNICAL DECISIONS CONVEY MEANING

Given the vital role that data visualization can play in analyzing data and delivering a persuasive human rights message, there is great temptation and good reason to incorporate it into the process of human rights research and its outputs, such as reports and other advocacy products. However, the power of data visualization must be harnessed with care. The techniques of data visualization are a form of knowledge production, with constraints and connotations associated with forms and their interpretation. The meanings conveyed by seemingly technical decisions must be unpacked and considered when designing human rights visualizations.

The keystone technique in the field of data visualization is "encoding" to visually identify a specific aspect of a dataset.[97] Visual encoding associates visual properties like location, color, shape, texture, and symbol with data properties like time,

[95] J. D. Aronson et al., *Video Analytics for Conflict Monitoring and Human Rights Documentation: Technical Report* (Pittsburgh: Carnegie Mellon University Center for Human Rights Science, 2015), www.cmu.edu/chrs/documents/ELAMP-Technical-Report.pdf.

[96] Rudiment and the Centre for Visual Computing, ARCADE: ARtillery Crater Analysis and Detection Engine, https://rudiment.info/project/arcade/.

[97] W. Cleveland and R. McGill, "Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods" (1984) 79 *Journal of the American Statistical Association* 531–54.

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category, and amount. More than one variable and visual encoding can be combined within the same representation, such as x-axis for time, y-axis for magnitude, and color for category.[98] Variables need not be strictly visual, either. Data can be encoded using different aspects of sound (tone, volume, pitch) or touch (height, location, texture).[99] A great power of visualization is the ability to combine multiple encodings within the same visual space, enabling rich exploration. Some kinds of data, like geographic data, can also act as a bridge between other kinds of data. For instance, poverty rates in a particular geographic area can be compared against resources and services available in the same geographic area.[100] A standard collection of chart styles has emerged as conventions, and these chart styles come preloaded in popular data tools like Microsoft Excel. As one's audience becomes familiar with certain chart forms, their legibility is reinforced. As the typographer Zuzanna Licko once noted, "You read best what you read most."[101] The pie chart, bar chart, and line chart have become visual conventions. However, the form of a visualization and its interface are not neutral; it constitutes a choice, a way of structuring experience and knowledge. Form imposes its own assumptions and arguments, and the most familiar and common forms of data visualization may not always be suitable for data presentation and can, in some cases, obscure or even distort findings. In the human rights context, it is important to reflect on design decisions and visual conventions – especially when designing research-based products for diverse and often international audiences.

Visual tone can also carry connotations. For instance, does a visualization make beautiful something monstrous and tragic? This is an especially important query in a field marked by its "affect-laden conception of humanity."[102] Presenting visualizations in a "neutral" style could downplay the assumptions behind the data and its collection and analysis. Seemingly less weighty design decisions can also affect the way a map or other graphic is perceived; for example, design decisions that affect color contrast and legibility can obscure a graphic's meaning or, at their worst, create a misleading visualization.

Color can also carry cultural weight. Consider the color orange, which is associated with Hindu nationalists in India and with Unionism and the Orange Order in Northern Ireland, and was used by groups that participated in the 2004–05 "Orange Revolution" in Ukraine. Depending on how color is used in a given visualization,

[98] Ibid.

[99] D. Carroll, S. Chakraborty, and J. Lazar, "Designing Accessible Visualizations: The Case of Designing a Weather Map for Blind Users," in C. Stephanidis and M. Antona (eds.), *Universal Access in Human-Computer Interaction, Design Methods, Tools, and Interaction Techniques for eInclusion*, vol. 8009 of *Lecture Notes in Computer Science* (Berlin: Springer, 2013), pp. 436–45.

[100] T. Bedi, A. Coudouel, and K. Simler (eds.), *More than a Pretty Picture: Using Poverty Maps to Design Better Policies and Interventions* (Washington, DC: World Bank, 2007).

[101] Zuzanna Licko, interview by R. VanderLans, in *Emigré*, 1990, 15, p. 43.

[102] L. A. Allen, "Martyr Bodies in the Media: Human Rights, Aesthetics, and the Politics of Immediation in the Palestinian Intifada" (2009) 36 *American Ethnologist* 161–80.

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such associations can invoke secondary cultural meanings, particularly when representing geopolitical data across borders.

VIII ACCESS AND INCLUSION

Particularly for the sake of advocacy, outreach, and transparency, it is important for human rights information to be accessible and inclusive. Though a strength of data visualization is the ability to invite readers to engage with analysis and communications, an ongoing challenge is access and inclusion. How can human rights researchers and NGOs make their visualizations accessible to the populations to whom their data is relevant? Or work with communities to help them access the tools and expertise necessary to generate their own data visualizations?

One challenge for interactive digital visualization is the physical constraints of the screen, particularly of small mobile screens. The popularity of smartphones and widespread mobile Internet access have overtaken desktop and broadband access in much of the world.[103] While the increasing ubiquity of access is promising, the smaller screen size poses a challenge to making complex data visualizations legible and interactive.

The physical attributes of a visualization and its interaction can profoundly affect how it is accessed and understood by users of different abilities. Limited motor control, color blindness, color vision deficiency, restricted vision, or blindness can affect how a visualization is read. The visualization community has made great strides toward awareness of color blindness and color vision deficiency. But while tools are available to check the accessibility of color use, there is still far more work to be done to make visualizations accessible to blind users. Can visual information be accessed through other means as well, such as accessible HTML, that can be processed by automated screen-reader software? Can the visualization be navigated with a keyboard instead of only by a mouse?

In addition to visual encodings, data visualization relies on culturally coded visual metaphors: an "up" symbol or bigger size means "more," time moves from left to right, clusters indicate similarity, big is important, etc. As a result, reading, interpreting, and understanding data visualizations require a certain degree of cultural and visual literacy. In the case of quantitative data visualizations, numeracy is key. The success of a data visualization for both analysis and advocacy relies not only on the visualization itself, but on its accessibility to the reader. For its advocacy work to promote better health, the design team behind the now ubiquitous Nutrition Facts label tested more than thirty variations of charts and other formats before settling on the organized table we know so well. They found that graphs, icons, and pie charts

[103] M. Kende, *Global Internet Report 2015: Mobile Evolution and Development of the Internet* (Reston, VA: Internet Society, 2015).

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were more complicated for consumers than they'd originally thought, requiring a relatively high degree of visual literacy to understand.[104]

IX CRITICAL MAPPING

Mapping is a particularly popular form of data visualization being used in human rights research and advocacy today. Critical cartography is a set of practices and critiques based on the premise that maps are not neutral; it holds that visual design decisions about what to include or exclude, what boundaries to show, etc., are political expressions about space and power. Authors choose the data to include or exclude and decide how to highlight it. Marginalized populations may be excluded from maps for a variety of reasons, or maps may privilege spaces of commerce over spaces of community. Commercial vendors may not consider it profitable to digitize the streets and addresses of villages in developing countries. State statistical agencies with limited resources must inevitably prioritize their activities and focus.

Even when focusing on specific evidence, decisions about what to include or exclude and how to represent visual elements can carry political implications; histories can be contentious, particularly where nationalism and national identities are woven into narratives of conflict. The drawing of maps can raise human rights issues in the act of visualization itself. For example, borders and place names can be particularly contentious. The government of China, for instance, takes border demarcations very seriously – confiscating maps that, through their visuals, "violate the country's positions on issues such as Taiwan, islands in the South China Sea or territory in dispute with India" or that reveal "sensitive information."[105] Lawmakers in India also considered a draft bill threatening fines and jail time for depicting or distributing a "wrong or false" map of its borders.[106] Human rights researchers need to take political sensitivities and significance into account when they engage in visualization involving maps – both the visual expression and where sensitive interactive media is hosted.

Mapping for social justice purposes has a long history, from the historical examples above to the current use of digital mapping. A powerful example of "counter-mapping," the Detroit Geographic Expedition was formed after the 1967 Detroit riot to conduct and publish research on racial injustice in Detroit and offered free college courses on geography and urban planning for inner-city African American students. The group critically challenged plans put forward by the

[104] J. Emerson, "Guns, butter and ballots: Citizens take charge by designing for better government" (2005) January–February *Communication Arts* 14–23.

[105] N. Thomas and M. Martina, "China tightens rules on maps amid territorial disputes," Reuters, December 16, 2015, www.reuters.com/article/us-china-maps-idUSKBN0TZ1AR20151216.

[106] Agencies, New Delhi, "7-year jail, Rs 100 crore fine for wrong depiction of India map," Times of India, May 5, 2016, timesofindia.indiatimes.com/india/7-year-jail-Rs-100-crore-fine-for-wrong-depiction-of-India-map/articleshow/52133221.cms.

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Board of Education, visualized inequities of Detroit's public spaces for children's play, and mapped traffic fatalities of children along commuter routes, all of which pointed to patterns of spatial and racial injustice in the built environment.[107]

To claim the power traditionally held by governments and companies, grassroots organizations and individuals are also using tools for digital mapmaking. For example, in 1993, Daniel Weiner and Trevor Harris worked with communities in the central lowlands of South Africa to develop participatory applications of GIS in support of the redistribution of natural resources in the post-apartheid transition.[108] By far the largest current open mapping collaboration is OpenStreetMap, a free editable map of the world. An ecosystem of tools has been developed around OpenStreetMap data, including some specifically designed for supporting humanitarian responses to crises.[109] Other projects are using mapping to capture local knowledge in order to assert claims of land ownership. Inspired by their work with indigenous communities in the Amazon, the organization Digital Democracy developed a method for contributing data to OpenStreetMap without having continuous access to the Internet.[110] The organization Hidden Pockets found that sexual and reproductive health services in Delhi were absent from Google's map, so set out to track this data and create its own publicly available map.[111]

X MOBILIZATION AND OUTREACH

Data visualization can be a powerful vehicle for collaboration and mobilization in human rights outreach and advocacy. It can be used to interface with activist members, donors, and allies. For instance, using visualization, one can illustrate the impact of one's findings or recommendations to present a compelling vision of what is possible. Using data visualization not only to describe systemic abuses, but also to render a concrete vision of the future and project an alternative vision and message of hope, can be a powerful way to mobilize supporters. Visually mapping the activities of supporters also provides participants with a visual overview of activities and creates a virtuous cycle of feedback as well as a sense of both transparency and solidarity. Making feedback visible can be an effective way of engaging participants to build solidarity and momentum.

Data visualization for advocacy can also be participatory in public space, inserted into the world. For example, in February 2009, a series of large-scale projections

[107] C. D'Ignazio, *The Detroit Geographic Expedition and Institute: A Case Study in Civic Mapping* (Cambridge, MA: MIT Center for Civic Media, 2013).
[108] D. Weiner and T. M. Harris, "Community-Integrated GIS for Land Reform in South Africa" (2003) 15 *URISA Journal* 61–73.
[109] *See* Humanitarian OpenStreetMap Team, https://hotosm.org.
[110] J. Halliday, "OpenStreetMap without Servers [Part 2]: A peer-to-peer OSM database," Digital Democracy, June 9, 2016, www.digital-democracy.org/blog/osm-p2p/.
[111] S. Bagchi, "Feminist mapping initiative tries to reclaim Delhi, one dot at a time," *FactorDaily*, June 21, 2016, https://factordaily.com/mapping-delhi-hidden-pockets/.

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were displayed at sites across the center of Bristol, England. Using a powerful video projector, organizers displayed on building facades the line of the future water level anticipated due to climate change.[112] On a smaller scale, in 1991, the artist Félix González-Torres created an emotionally powerful series of portraits of friends with HIV/AIDS using piles of candy to match their body weight. Viewers were encouraged to take a piece of candy as they passed each portrait, thereby reducing the weight of the pile, performing, in essence, the wasting and loss of weight caused by the illness before each person's death, and quietly implicating themselves.[113]

XI TECHNICAL SUSTAINABILITY

Data visualizations are often presented in paper copies of reports and briefs, but they also figure prominently in web-based communications by human rights organizations, thus making an understanding of that technology essential to maintaining best practices with respect to data and data visualizations. A growing number of human rights visualizations have also moved beyond the presentation of a single view of a given dataset, and instead allow users to explore data in online applications. However, online databases sometimes require ongoing maintenance, particularly when they rely on external services such as maps or timelines hosted by third parties. Amnesty International launched a series of interactive data sites in 2007 with "Eyes on Darfur," followed by "Eyes on Pakistan" in 2010, "Eyes on Nigeria" in 2011, and "Eyes on Syria" in 2012, to map human rights abuses in those regions. Whereas the 2007 "Eyes on Darfur" project hosted satellite imagery on Amnesty's own web server, the Syria and Nigeria sites used Google Maps to display points of interest. Google Maps provides a low-cost, easy-to-use, web-based interface to map information, which is attractive for human rights organizations with budgetary constraints. However, as Amnesty International's experience illustrates, reliance on a third-party service provider comes with a long-term cost: By 2016, Google had updated its interface and both "Eyes on Syria" and "Eyes on Nigeria" no longer functioned. Amnesty would be required to update the back-end code for these sites in order to continue to plot information on Google Maps. Though human rights and humanitarian crises continue in these countries, the "interactive evidence" in Amnesty International's visualization has become inaccessible.

Periodic updating of interactive sites is, in fact, essential to maintaining their accessibility and relevance. While "Eyes on Darfur" continues to function, its use of Flash[114] to display information makes it inaccessible on tablet and mobile devices,

[112] Watermarks project, "Visualizing Sea Level Rise," February 2009, www.watermarksproject.org.

[113] F. Gonzalez-Torres, *Untitled (Portrait of Ross in L.A.)*, 1991, candies individually wrapped in multicolor cellophane, endless supply, Art Institute of Chicago.

[114] Flash is a multimedia software package the runs primarily in web browsers. Flash enables web browsers to stream audio or video, play animation and interactive games, and interact with rich applications. It has been criticized for its poor accessibility and a series of high-profile security

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which have become popular since the site's development in 2007 and do not support Flash. The Pakistan site featured "a geocoded database of more than 2,300 publicly reported incidents occurring between 2005 and 2009."[115] A collection of rights-related incidents of that scale represents a treasure trove of possible human rights cases and a powerful baseline by which to judge reports of ongoing abuse. As of 2016, however, eyesonpakistan.org is no longer online and its database is no longer accessible. The apparent failure to prioritize or plan for the demands of changing technology and the lack of ongoing technical support means it is no longer possible for human rights researchers and advocates to use the Syria, Nigeria, or Pakistan data.

One way to mitigate the obsolescence that plagued the Amnesty sites is to make both the data and the source code of a visualization readily available for download by users. This would allow visitors to access the raw data regardless of the technical implementation of the interactive interface. Though still rare among human rights NGOs, this is a growing practice among news organizations. The evolving field of data journalism offers one view of things to come. "Computer-assisted reporting" and "data-driven journalism" use spreadsheets and databases to help find patterns in data by using statistical methods and other techniques from the social sciences. The findings of the investigations are often presented through interactive news applications and data visualizations that can engage readers with data-driven reporting in a richer way, beyond the constraints of print. News organizations are increasingly posting these projects, their data, and tools to code-sharing websites like GitHub for others to download, use, and modify.[116] Like human rights organizations, journalists face limited resources and technical overhead, but news media are, thus far, more readily embracing the use of data analysis to drive investigations and visualization for effective storytelling. Any effort to share the data behind human rights reporting or visualization will need to carefully grapple with crucial ethical and security challenges, including confidentiality and anonymization, consent, and potential misuse of the data by abusive governments or other opponents.

vulnerabilities. Released in 2007, the Apple iPhone does not have the ability to run Flash, nor does the Apple iPad, released in 2010. In November 2011, Adobe announced that it would no longer support Flash for mobile browsers. The popularity of Flash has continued to decline and in July 2017, Adobe announced it will end development and distribution of Flash in 2020. *See* C. Warren, "The Life, Death and Rebirth of Adobe Flash," *Mashable*, November 19, 2012, http://mashable.com/2012/11/19/history-of-flash/ and Adobe Corporate Communications, "Flash & the future of interactive content," July 25, 2017, https://theblog.adobe.com/adobe-flash-update/

[115] Amnesty International, "Pakistan: Millions Suffer in Suffer in [sic] Human Rights Free Zone in Northwest Pakistan," June 10, 2010, www.amnestyusa.org/news/press-releases/pakistan-millions-suffer-in-suffer-in-human-rights-free-zone-in-northwest-pakistan.

[116] See this list of GitHub accounts of various news organizations: https://github.com/silva-shih/open-journalism.

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XII CONCLUSION

Human rights researchers and advocates are adding new methodologies to their toolbox, drawing on emerging technologies as well as established data analysis techniques to enhance and expand their work. Data visualization holds exciting potential, bringing new techniques of knowledge production, analysis, and communication to human rights research and advocacy. Organizations are increasingly recognizing the power of data visualization to support human rights analysis and arguments to help make a memorable and persuasive case for change.

Enabled by digital technology and engagement with data, effective visualization is a powerful tool for understanding social problems and their potential solutions. While journalism and academic disciplines, including the social sciences, are using data visualization for both analysis and communication, the human rights field is just beginning to tap its potential. As interest grows, human rights organizations will need to struggle with the ethical and practical considerations of producing data visualizations.[117] More research is still needed on the effective use of data visualization and human rights. Used in a principled way, however, data visualization can benefit human rights researchers and advocates, and those whose rights are in danger. It can help researchers identify patterns and trends; clarify a call to action; make data analysis compelling, understandable, and interactive; rally supporters; and perhaps even visualize the effects of activism itself.

[117] J. Emerson, "Ten Challenges to the Use of Data Visualization in Human Rights," *Social Design Notes*, February 9, 2016, http://backspace.com/notes/2016/02/ten-challenges.php.

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