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**Title: Human computation and conflict**
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# Abstract

As human computation tools and techniques increase in power and pervasiveness so too does their impact on factors affecting the likelihood of armed conflict, and on armed conflict itself. Some factors such as rapid economic decline, environmental stress, private motivation, a failure of the social contract, and social distance to potential enemies have been shown through empirical studies to increase the likelihood of armed conflict. The same studies have identified full democracy and high levels of education as decreasing the likelihood of conflict. Informed and inspired by this growing body of research, we discuss the current and future impact of human computation taking a socio-technical perspective. In particular we focus on ways human computation can facilitate novel forms of interaction between humans toward specific objectives. Topics include the potential of human computation to influence interactions that in turn support democracy, consumer awareness, human connections, education, poverty reduction, citizen journalism, crisis informatics, digital archives, reconciliation, and warfare.

# 1 Introduction

Technological developments play a critical role in arenas of war, from increasing or decreasing their likelihood, to changing the nature of warfare, to affecting recovery. Writing, cartography, advances in mathematics, and the rise of robotics are examples of such developments. Human computation is a relatively new, but already significant contributor to this area. In this chapter, we explore the topic of human computation and conflict from the perspective of trying to diminish the damaging impacts of war. In particular, we focus on how human computation may influence, positively or negatively, efforts to prevent, de-escalate, and recover from armed conflict in the early 21st century.

Our approach reflects our interest in minimizing the human and financial cost of warfare. We draw from recent empirical research on the causes of war at a societal level, reconciliation efforts at the community level, and drivers of empathy and compassion at a personal level. We proceed by highlighting a range of work from the area of human-computer interaction (HCI) and the diverse disciplines and research streams that it brings together (e.g., persuasive computing, crisis informatics, collapse informatics, etc.). These exemplar projects weave together research and practice, exploring the diverse ways that human computation might help (or hinder) efforts to avoid, minimize and recover from armed conflict. We also suggest research questions that scholars embarking on these projects are well positioned to address. In these discussions we focus on human computation from an HCI perspective. We highlight interactive technologies and techniques that facilitate novel forms of human interaction in support of explicit objectives.

We stress the need for work in this area to be explicitly socio-technical in approach. We strive to avoid technological deterministic positioning, recognizing the influence of policy and praxis, values and valuing in this complex human arena. The features of computational tools do not stand in isolation, they are enmeshed in complicated modern ecosystems. In other words, we believe that attention must be paid to the social and cultural context within which specific human computation technologies will be used. In this way, the impact of these tools can be better understood and objectives are more likely to be achieved in specific contexts.

## 2 Empirical Research and Conflict

During the past 15 years, solid empirical research has significantly enriched discussions around the causes of armed conflict. Prominent scholars, such as Frances Stewart and Paul Collier have used 50 years of human development data from the United Nations to understand the conditions that make it more likely that a country will be part of a civil or international war in the near future (Stewart, 2002; Collier, 2007). Collier, in particular, has done extensive statistical analyses of these data sets. They found private motivation (i.e. financial profit) to be a primary motivator of armed conflict, often linked to trade in primary commodities. Other causes include a failure of the social contract, rapid economic decline and social unrest, environmental stress, certain forms of ethnic and religious fractionalization, a high proportion of young men in the population, partially democratic governments, and geographic and historical factors (Stewart, 2002; Collier, 2007; DeRouen and Goldfinch, 2005; Nardi, this volume). These researchers have also identified factors that reduce the likelihood of armed conflict. These factors include being a fully democratic country, and having a better educated population (Stewart, 2002; Collier, 2007; DeRouen and Goldfinch, 2005). Collier, in particular, found that each additional year of education for the general population reduces the risk of civil war by about 20 percent in a country (Collier, 2007). A recent issue of Science magazine has explored additional factors with respect to their impact on armed conflict including the role of gender, climate change, empathy, racism, and modern forms of communication such as Twitter (Riddihough et al., 2012). In our discussion of human computation, we present how some of the key factors (e.g., political engagement, health, social stability, connectedness, education, empathy, access to modes of communication) are-and will likely continue to be-affected by human computation. A more detailed discussion of these factors can be found in a paper by Hourcade and Bullock-Rest (2011).

In addition to societal factors, psychologists and neurologists have provided novel insights into how empathy and compassion work in individual minds and across groups. In his recent book *The Science of Evil*, Simon Baron-Cohen discusses the brain's empathy circuit and how damage to these parts of the brain affect empathy. In doing so, he also discusses the elements that activate the circuit, including touch, gaze, seeing someone else do or experience something, and recognizing emotions (Baron-Cohen, 2011). These are critical to our discussion of human computation as technologies that do not let us see other people or understand how they feel can prevent empathy and compassion from manifesting during periods of critical communications.

# 3 Addressing the Precursors to Conflict

In the following sections the reader will find many examples of measures that appear promising in term of addressing the causes of war, reflecting our stance that preventing conflict is far more cost effective than attempting to ameliorate its effects once begun.

## 3.1 Politics, Democracy and Political Engagement

Given that fully democratic nation states are less likely to participate in armed conflicts than less democratic states, studying how human computation technologies are leveraged in political campaigns is a pertinent topic. This is one area where the effects of tools using human computation techniques are already noticeable, with political campaigns attempting to leverage new mobilization strategies. For example, in the United States, the 2012 presidential campaign in support of Barack Obama used combinations of web and mobile apps along with a massive database that made it very easy to distribute work for the campaign and to aggregate individual decisions and actions into a coherent whole. These tools were used to organize volunteers, manage personal visits and phone calls in real time, even enabling volunteers to make quick, targeted phone calls when they only had a few minutes available. They even matched volunteers with the people they would contact based on common life experiences (Lohr, 2012).

Social media and user-generated content are also playing a role. One example is the successful online campaign to defeat the SOPA/PIPA legislation in the United States, which initially had large bipartisan support in Congress. While not entirely a grassroots campaign since it had the support of the likes of Wikipedia and Google, it provides an example of how online organizing can influence decisions by elected officials (Kravets, 2012). These tactics are increasingly used by advocacy groups who prepare messages and ask supporters to mail them to their elected representatives through automated systems. Messages that may have taken significant effort or cost in writing and mailing a letter, or making a long distance phone call 20 years ago, are now “delivered” after only a few clicks. Thus, the convincing of politicians is quickly distributed to interested citizens who can quickly comment and exercise influence.

These efforts are spreading. Just north of the United States, extreme budget cuts proposed in 2013 motivated the grassroots development of the Budget ReACTion Project (BRP). BRP is an initiative designed to scaffold the ability of communities across Canada to work collaboratively to analyze the 2013 budget and how it will affect local services (www.openthebudget.ca). BRP is using crowdsourcing, a catch-all term for distributed problem solving. In this case algorithms outsource specific steps to human experts, engaging local policy wonks in a breakdown of the hundreds of pages of the budget proposal. It is hoped that by dividing up the budget and localizing the level of analysis, BRP will help communities across the nation-state come to a richer understanding of the likely influences of the recent budget proposal, so they can mobilize action more effectively.

A positive from some of the examples above is that human computation may provide ways for citizens to increase their civic engagement. Consider the Budget ReACTion Project discussed above and how the use of algorithms for dividing the work makes it easier for policy experts to participate in parsing government budget proposals, in turn this parsing makes it possible for local citizens to take informed action in response to these proposals. This may involve discussing political issues with neighbors, potentially engaging the brain's empathy circuit. These types of engagement may also lead to a better informed citizenry, something that has long been highlighted as a necessary component of a well-functioning democracy. Human computation also provides more opportunities for people to organize campaigns and develop informed proposals that make their way from the bottom up, increasing participation in the democratic process.

Obviously activism and political campaigns can also be used to start wars or stigmatize groups; consider the use of online "guerrilla tactics" to promote or demote content and opinion. Activist groups are training followers on these tactics so that when news stories about a topic of interest are presented in an online forum, followers are alerted and proceed to flood discussion areas related to the story with comments supporting their viewpoint, adding "likes" to friendly comments and "dislikes" to opposing comments (Hiar, 2010). Even in widely read national news media, a hundred online "soldiers" are able to manipulate their views into the "most liked" category for a given story, providing an inaccurate sense of popular opinion on a matter. These tactics could easily extend to efforts of intimidation, suppressing the opinions of those who have moderate opinions, and we can see this happening in online forums when things get particularly heated. Eventually, extremists are often the only ones left. Guerrilla tactics may also be used to quickly spread misinformation. Additionally, there is the possibility that human-computation could lead to more top-down approaches where people get used to repeating slogans or "talking points" coming from organizations or political parties (e.g., through the use of the Obama campaign's extensive voters database), without researching the information and reaching their own conclusions. There is no question that human computation tools in the political arena have the potential to be used to increase the chances of armed conflict.

One of the most compelling areas of research on political engagement explores using human computation to entice citizens to interact with each other around divisive political topics in constructive ways. One HCI-focused research group investigating this area is the University of Washington's Engage Project. This team of researchers is exploring the design of interactive, digital systems that encourage reflective engagement on charged topics, with a recent focus on voting (e.g., Freelon, Kriplean, et. al., 2011). Their Living Voters Guide aims to bring "... voters together to discuss and integrate their perspectives, in contrast to our media environment of divisive soundbites. It is a voters' guide that is co-created by everyone who participates. It evolves as citizens consider the tradeoffs for each measure."

There are further obstacles to supporting civil, civic debate when considering those living under more restrictive political regimes. In many contemporary nation-states stating the wrong opinion online can land an individual, and those who manage the site, in prison. How can human

computing endeavors and associated policies help protect open discourse in politically fraught environments? The Voices from the Rwanda Tribunal project is investigating this space, designing a system to foster discourse in Rwanda, engaging the tensions related to citizens' abilities to express opinions related to the United Nations Criminal Tribunal for Rwanda in a highly constrained political climate (e.g., Nathan, Lake, et. al., 2010). This project underscores the need to take political conditions seriously as technological features that suggest but are unable to guarantee anonymity can have dire consequences for individuals who express ideas deemed unfavorable by the current political regime.

It is also important to keep in mind that requests for engagement in political activities could quickly become overwhelming, with ever urgent requests from advocacy groups haragunging citizens for their participation. There is a clear possibility that this could overwhelm people and lead them to disengage from all such activities. Research is needed so opportunities to engage are presented in a manner that helps individuals assess the importance of participation and its repercussions in relation to their interests, values and the wider political context.

## 3.2 Consumer awareness

Primary commodities are often used to fund wars, especially civil wars waged in low-income regions of the world. Ross (2006) identified a causal relationship between oil, gas, and diamond wealth and the onset of civil war, with a marked increase in the likelihood of this happening starting in the 1970s. In addition, he found that conflict duration was linked to the amount of "contraband" possible, including gemstones, timber, and narcotics.

Primary commodities have to be sold somewhere and often end up in the hands of consumers who are unaware that they are indirectly funding a violent civil war halfway across the world. The eastern side of the Democratic Republic of Congo is a region where the insatiable demand for rare earth minerals needed to build contemporary digital tools continues to add fuel to horrific conflict. Simply stated, tantalum (recovered from ore minerals such as columbite and tantalite) incorporated into a new cellphone or laptop can lead to more weapons being purchased by violent warlords (Smith & Mantz, 2006). There are increasing efforts to provide consumers with the ability to trace what they purchase. Many grocery stores and supermarkets specializing in "natural" products increasingly display the origins of their merchandise. Clothing companies (e.g., All American Clothing) are also moving to provide tracing of their supply chain, especially when they wish to highlight a product's origin in a particular country.

Human computation could play a role in bringing further transparency to product tracing. One way would be to enable people who work in different parts of the supply chain to provide testimonies or even live feeds of their workdays. The technology exists but the practices and policies of such broadcasting are still developing. Similarly human computation could play a role in providing unofficial tracing of products, enabling people working in the supply chain to provide "on the ground" testimonies and information on the products consumers may purchase, even if the manufacturing companies are not interested in supporting this type of information sharing.

Buycott is an example of such an app, enabling consumers to scan barcodes and instantly learn about the companies involved in manufacturing a product (Buycott, 2013).

Human computation could be a game changer in product traceability, enabling better informed consumers who may come to expect ready access to that information and distrust products that do not provide it. In turn, this could potentially deal a serious blow to the financing of civil wars, and to companies and organizations that directly profit from the hidden nature of the funding sources for these conflicts. Black lists of products, for example, could be provided by organizations consumers trust.

An unintended negative effect could occur because people who do decide to participate in “on the ground” reporting could risk their jobs and livelihoods. If employers discover that individual employees are revealing less savory practices, questionable conditions and connections to conflict, they may fire these employees. There is also the likelihood of misrepresentation, with companies either obscuring the true origins of products or the broader socio-cultural conditions in which the products were manufactured (similar to “green washing”). Human computation traceability endeavors require a high level of trust and oversight processes to be developed.

The ability to provide product tracing is still in its infancy and there is the need for investigations into robust ways of providing this data that incorporate human computation techniques. This may require generating an automated narrative of how a product got to you based on individual contributions from people throughout the supply chain. It would be useful for tools to be able to provide the right amount of information tailored to particular consumer interests (e.g., conflict prevention or ecological footprint) while enabling a quick, intuitive way of visualizing consumer impact (e.g., visual analytics).

## 3.3 Humanizing Connections

Convincing people to support a war often involves the demonization and dehumanization of “the other”. This happens through the spectrum of actors in armed conflicts, from democracies to terrorist groups (Ivie, 1980; Weimann, 2004). Demonization efforts are much harder to accomplish if many people are familiar with members of the other groups and are aware of their common humanity. The increasing worldwide availability of the Internet can make it easier than in years past to forge connections between people from widely different groups. Social media provides interesting platforms for these connections to happen in a massively distributed way.

A particularly compelling example of these connections comes from the use of early versions of social networking software on the island of Cyprus during the 1990s. At the time, people from the Greek and Turkish regions of the island were forbidden to communicate with each other and could only meet by travelling to other countries. Digital connectivity in the early years of the Internet provided an opportunity for dialog that likely played a role in the thawing of tensions between the two sides (Hourcade et al., 2012).

There have also been unanticipated opportunities for massive international collaborations. For example, consider musical compilations or movies put together by a large number of online contributors from around the world. Oscar-winning director Kevin Macdonald put together the feature film *Life in a Day* based on thousands of contributions from around the world (Macdonald, 2011).

Finally, there could be opportunities to better understand events from the other side's point of view by engaging in discussions following rules that lead toward agreements. There are examples of co-narrating a conflict (none other than the Israeli-Palestinian) with multitouch interactive tabletops that could be taken to the online world (Zancanaro et al., 2012). The opportunities for creative collaborations with people we may never meet face-to-face will continue to increase and provide unprecedented worldwide humanizing connections.

Massive online connections with people from other groups can help humanize them and reduce the social distance between people from different backgrounds, cultures and value systems. Members of opposing sides may find commonalities in activities or interests that may take them away from thinking only about their differences. It certainly seems harder to support waging war, and potentially killing, the same people who helped you create something of beauty.

Online connections can also be used to affirm extreme views and communicate only with people who share one's ideas. It is easy nowadays for a racist to find a large number of people who will validate those ideas online, while 15 years ago in many places it would have been far more difficult to identify and engage with a handful of like-minded people. There is a danger of creating echo chambers for political views that human computation efforts can further amplify, pulling people away from moderation because they remove dissenting views.

The main challenge for future research in humanizing connections is in establishing connections when people do not previously know each other. While this is already happening to some degree, especially for projects that receive a lot of publicity, such as *Life in a day*, it could potentially happen much more often for a variety of creative activities that may benefit from international teams coming together online. A greater challenge is likely in providing people with incentives to join communities where there are respectful yet dissenting opinions, instead of joining communities that solely provide affirmation for existing views and positions. There may also be opportunities for research in designing massive online games that have peace instead of world domination as a goal. Role- playing games such as *Peacemaker* exist to challenge one's personal skills at conflict resolution, but there are certainly opportunities for taking these concepts to a larger scale.

## 3.4 Education

While it is unclear exactly why higher educational levels lead to a reduced likelihood of conflict, it is likely due to a combination of more knowledge about people and the world combined with greater economic opportunities that make entering an armed conflict a less palatable endeavor.

Human computation is increasingly playing an important role in education (Beat et al, this volume).

Massive Online Open Courses (MOOCs) are arguably the most hyped phenomena across academia in 2013. These are usually free (hence “open”) courses available online and intended for a massive audience. While these increasingly available offerings are primarily designed and targeted to a college-level audience, the impact of the approach could potentially be realized at other levels of education. For example, something that easily separates groups of people is language. MOOCs could be used for foreign language instruction in primary and secondary schools, helping fill a gap in countries where there may be a shortage of foreign language instructors. Such offerings could help shorten the amount of time needed for countries to make qualitative leaps in their ability to teach specific subjects.

These efforts would have much to learn from other large scale efforts connecting classrooms across the world. For example, the collarative project iPoPP (created by GlobalSchoolNet.org and eLanguages.org) is a global e-learning platform for multi-lingual, project-driven collaboration (http://www.globalschoolnet.org/ipopp/about-ipopp.html). It draws upon constructivist learning methodology and collaborative learning strategies to support projects amongst students from different language backgrounds. There are also less formal examples of multi-language, online collaborations that scaffold children teaching each other about their lives and activities (e.g., collaboratory blogs and YouTube videos) that further enrich the area of human computation.

The main positive about these endeavors is the sheer numbers of diverse peoples that may be reached. If motivated they may acquire valuable skills, learn novel points of view, open their minds, and develop critical thinking skills. The positives are more likely to occur in regions of the world that are far from educational resources, where people with the necessary background to teach may simply not be available.

Negatives may also come from these new technological practices in the form of decreasing the number of initiatives to improve educational institutions based within local communities. This may be of particular concern to regions of the world where insufficient resources are dedicated to education, and children may engage with instructors or others who are unaware of local norms, culture and concerns, risking further marginalization of these young people and decreasing their motivation to actively participate in the learning experience. There is growing evidence that college students may be given credit for MOOCs that do not deliver the same quality of education as in-person courses at institutions without enough funding to provide an adequate number of courses given their enrollment numbers (Gardner & Young, 2013). This problematic trend may eventually work its way to all levels of education.

The biggest impact in terms of peace will only be accomplished if human computation efforts can contribute to educational levels in regions of the world where people are mostly illiterate. This means the difficulties of getting any type of MOOC to these settings would be significant in terms of developing supportive socio-technical infrastructures for student access. A

compromise would be to use this technology to help accelerate the training of teachers, and do this while providing local content in a culturally appropriate way.

### 3.5 Poverty Reduction

Widespread poverty and a failure of the social contract can make joining an armed conflict more attractive, since the alternative is not particularly agreeable. Education and good governance could certainly help reduce poverty, but other initiatives that make use of human computation could provide additional critical help. An example that makes use of human computation approaches is peer-to-peer micro-financing. One of the best known examples is Kiva (kiva.org), a website that matches people with small amounts of money to lend, who are most likely in high-income regions of the world, with people in need of loans for small businesses in low-income regions of the world. As of March, 2013, after about 8 years of activity, Kiva had almost one million lenders and had given out over 400 million US dollars in loans to people in 67 different countries. Arguably the most significant statistic is that Kiva has achieved a 99% repayment rate.

Kiva shows a positive example of how peer-to-peer micro-financing can significantly address poverty. Thousands of people have accessed its loans, individuals who likely would not have had other ways to invest in their educational endeavors or small businesses. At the very least, initiatives like Kiva can provide an alternative to predatory loans whereas taking a loan becomes cost effective, feasible and convenient. These services can also cut down on the need for “middle-men”, reducing the cost of giving a loan and receiving repayment.

Micro-financing is not immune to fraud, and while this has not yet hurt peer-to-peer micro-financing significantly, as the numbers increase, so will the likelihood of attracting scammers and hackers. The ability to scale auditing for large peer-to-peer micro-financing efforts could be costly and and difficult. The failure of a highly visible initiative could cause significant damage to this approach to poverty reduction.

Substantially scaling up these efforts will require research on how to design systems that on a large scale can be trusted, reliable, transparent, and understandable by their users (both lenders and borrowers).

## 4 Ameliorative Actions

Once underway how might human computation efforts address the horrific realities of conflict, potentially easing the suffering of those involved? In particular, how might these efforts empower those most affected to aid in de-escalating war?

### 4.1 Citizen journalism

With an ever increasing number of people carrying smartphones that can record video or

broadcast it live, the amount of citizen journalism entering mainstream media has grown exponentially. Anyone carrying such a device can record events and quickly share them. This can potentially reduce the incentives for parties in conflict to use excessive violence as it is likely to be reported and may be difficult to deny or justify. This can prevent political disagreements from scaling into armed confrontations. For example, videos of an incident at the University of California, Davis where a police officer used pepper spray on demonstrators resulted in widespread condemnation, with the university later paying demonstrators one million US dollars to settle the lawsuit (Favate, 2012). If the incident had not been video recorded, police officers could have more easily argued that the use of pepper spray was justified.

The past few years have seen a flurry of development as various organizations (NGO, non-profit and for-profit) are developing platforms to support citizen journalism. An example is Ushahidi Crisis Mapping (http://ushahidi.com) (see also Meier, this volume). Ushahidi was originally created to track post-election violence in Kenya in 2008, providing a free open-source tool for mapping and tracking information via text, email, twitter, and other forms of communication. Today it is used by political activists, but also made a transition into use for disaster relief – mapping damage following 2010's "Snowmaggedon" on the east coast of the US and the massive earthquakes in Haiti (Ushahidi, 2013).

Another project, more focused on specifically supporting citizen journalism is Global Voices Online. Global Voices is a massive blogging community dedicated to bringing citizen reporting from around the world into one centralized location. Project members seek to create a credible source for citizen journalism in order to promote free speech and bring a more equal level of media attention to happenings around the world. Significantly, posts are translated into over 30 languages. (http://globalvoices.org)

Massive citizen journalism initiatives have the potential of preventing violence because of the difficulty of perpetrators to deny their involvement in the activities. But it also has the potential to de-escalate war if citizens see the gory consequences of their support. For example, in the most recent conflict between Israel and Palestinians in the Gaza strip, both sides made efforts to immediately show the impact of the other side's strikes on civilians, and in particular on children (Mackey, 2012). This helped put international pressure on both sides to reach a ceasefire. The same cannot be said of conflicts such as the civil war in Syria where media often has to be smuggled out of the country and tends to show consequences of violence without context (i.e. who was directly involved) as opposed to live or recorded video footage of violent events.

There is also the potential for citizen journalism techniques to be used to monitor ceasefires. Thousands of live camera feeds from a sensitive area could be used to instill trust between warring sides, and make it less likely for one side to break the ceasefire without it been clear they were to blame.

There can also be negatives to these developments. For example, seeing violence may increase the support for violence as people may deeply desire acts of revenge. Likewise violence from a

small number of people belonging to one group, may be used to justify violence against an entire group. Hence, people who seek to paint a group in a negative light will have a much larger amount of material to support their views. An additional issue with having large numbers of video cameras constantly running is the loss of privacy and the potential for massive spying, especially in countries where political dissent is simply not tolerated.

The blessing and curse of citizen journalism is the overwhelming quantity and varying quality of information that can be generated related to a single incident. Finding relevant information and verifying this information leads to a host of research questions, visualization challenges and aggregation opportunities. Scaling up these systems so they can be robust and are difficult to subvert will be critical to ensure their effectiveness.

## 4.2 Dealing with Emergencies: Crisis Informatics

The term Crisis Informatics was coined by Chris Hagar and grew out of her work with farming communities in the United Kingdom affected by extreme quarantine measures during the Hoof and Mouth disease outbreak in 2001 (Hagar, 2006; Hagar & Haythornthwaite, 2005). Others have contributed significant work to this field, investigating socio-technical interactions that occur during times of extreme crisis with an eye towards developing ways to support the mitigation of suffering. Although Crisis Informatics research is not limited to the time period when a crisis is underway, some of the most compelling scholarship has contributed  powerful analysis of activities during this phase of a crisis (e.g., Palen & Starbird, 2011; Palen, Vieweg & Anderson, 2011).

Specific Crisis Informatics related projects include the Humanitarian OpenStreetMap Team (HOT). HOT draws upon the wiki project OpenStreetMap to collaboratively map crises and disasters. Volunteers working remotely gather data based on satellite imagery or other available data sets. This information is used to inform and direct humanitarian responders on-location as they attempt to coordinate efforts quickly and efficiently. Areas where HOT mapping projects have occurred include the famine in Somalia, the Presidential Election crisis in Ivory Coast, and earthquake damage in Haiti. (http://hot.openstreetmap.org/).

Crisis Informatics offers significant potential in human computing terms by providing insights into methods for combining local, on the ground expert knowledge, with distributed volunteer expertise from around the world, enhanced with access to open data sources.

Potential drawbacks to this field are related to the fact that many different players, with different motivations have access to open systems. Reports of crisis can bring aid, but can also bring those who wish to benefit from the period of chaos and destruction. There are many open research questions related to both technical and sociological conundrums that face Crisis Informatics related efforts. These include issues of scale, addressing the challenge of “bad actors”, prioritizing needs, and connecting needs with expertise and resources.

# 5 Recovery

Armed conflicts leave indescribable suffering and heartache in their wake. Post conflict states often experience a time when individuals are interested in pursuing activities related to justice and reconciliation efforts. The efforts are aimed at identifying and addressing wartime atrocities and grievances and ways for neighbors (whether at the nation or street level) to trust each other again. There is a growing realization that the goals of justice and reconciliation are not necessarily linked and require different approaches in order to avoid exacerbating harms and contributing to the likelihood of future conflict (Fletcher and Weinstein, 2002).

Contemporary conceptualizations of *justice* and modern court systems require documentation, recorded evidence of wrongdoing to support investigations, indictments, and hearings. In order for affected individuals to believe that justice has been delivered, they need have some evidence that the judicial process was followed. Yet, *reconciliation* efforts require the development of mutual understanding and a rebuilding of trust. Activities that focus on attribution and blame do not contribute to reconciliation. Instead, reconciliation efforts require the development of discourse between the affected parties, speaking and being heard. Human computation developments, many already introduced above, appear promising in terms of supporting both justice and recovery efforts.

## 5.1 Archives and Justice

For centuries archivists have worked to preserve records, developing theory and practice related to critical attributes of records including issues of trust, authenticity and reliability. Archivists recognize the power of well managed records in battling revisionist histories and shifting technologies that threaten our ability to understand and learn from our past. Governments and organizations with a deep appreciation for the importance of documenting their history for the longer-term (decades and centuries rather than over months and years) hire archivists to manage their records. Yet for most of us the term archive is used as a verb because we are unaware of the deep body of scholarship that archivists draw upon when they engage in archival practice and study. To archive something in the colloquial sense simply means to save it for the very short term (i.e., hit the save button and perhaps put it in a folder). When it comes to efforts to support justice after conflict, nation-states and organizations who have had the ability to maintain records that hold up in court are far better positioned to see justice upheld.

Yet individuals, grassroots organizations, non-profits with low operating budgets and “seat of the pants” daily operations are not well positioned to contribute records considered trustworthy, reliable, and authentic to the courts. This is an area where human computation is beginning to contribute. While associated with earlier projects under the citizen journalism section that use citizen submitted video to share atrocities from around the world, WITNESS, a non-profit that uses video to document human rights abuses, also supports a media archive. The goal of the archive is to “...support of advocacy, prosecution of justice, truth telling, and the historical record. We believe that archives serve a critical role in human rights advocacy, by protecting and

preserving evidence, restoring memory, ensuring the endurance of under-represented voices, and as a bulwark against impunity and forgetting." (http://witness.org/media-archive/about-the-collection). In large part, the professional archivists and digital preservation professionals that work for and with WITNESS aim to provide support for longer-term accountability by helping future generations understand some of the missing portions of official nation-state histories. The organization holds footage of atrocities as they occurred, victim and witness testimony and evidentiary submissions. These materials come from the people most affected by armed conflicts rather than nation-state bureaucracies. To ensure the sustainability of this project and others in this vein, significant resources and socio-technical, human computation research will be necessary.

These types of activities require increasingly complicated modes of verification and long-term stewardship as digital tools and processes become more complex. Modern digital tools have many amazing attributes (e.g., small, lightweight, inexpensive) but this technology is still in its infancy and we know that there are significant challenges to preserving bits and bytes along with their provenance over the longer term. Efforts to create trusted, digital repositories are underway, but there are still many unknowns when dealing with the digital record lifecycle, from point of creation to long-term preservation.

## 5.2 Digital Media and Reconciliation

There is a long and well accepted practice of supporting 'truth telling' activities within and between communities recovering from periods of extreme conflict (e.g., armed conflicts between nation-states, civil war, genocide). Stakeholders, whether perceived as victim, witness, or aggressor are asked to come forward and share their version of particularly traumatic events associated with the conflict. The belief stems from the idea that without acknowledging deep harms and different perspectives on these harms, recovery is more difficult and a return to conflict is likely.

Truth and Reconciliation Committees (TRCs) such as Canada's ongoing court sanctioned TRC provide a well established method for structuring truth telling events (Zalaquet, 1997) often a first step in a longer stabilization process (Long and Brecke, 2003). Canada's TRC is holding events across the country to acknowledge the extensive harms done to thousands of Aboriginal children, their families and their communities during the 130 year period when the federal government removed Aboriginal children from their homes and shipped them off to live in the (typically) inhumane conditions of Indian Residential Schools. Truth telling activities that occur in TRC sponsored events provide an opportunity for members of the various affected parties (in Canada's case government officials, former students, victims' family members, non-Aboriginal Canadians and members of religious organizations who helped run the schools) to come together and share their understandings of deeply distressing events.

How might the distributed, grassroots nature of social media applications and other more technically advanced human computation developments contribute to truth telling based

reconciliation efforts, particularly in areas recovering from armed conflict? Recent work by Michael Best and his colleagues working in collaboration with Liberia's TRC provides initial answers to this question by carefully measuring and documenting the influence of rich digital media engagements, in this case involving the recording and viewing of video through a kiosk that toured the country, in support of the precursors to truth telling activities (Best, et.al., 2011). Although examples of media rich reconciliation efforts abound, the work in Liberia is distinct because they have attempted to empirically measure the influence of their digital media intervention.

Although endeavours in this area may appear similar to our earlier discussion of promoting human connections and empathy, it is critical to keep in mind that here we are considering human computation engagements with individuals, communities and nations that have undergone extreme trauma and are working through terribly painful memories. Although early work in the area of rich digital media and reconciliation efforts appears promising the obstacles are formidable in terms of establishing the infrastructure, both social and technical, needed to sustain and learn from initial efforts to promote reconciliation through rich digital engagement.

# 6 Human Computation and the Future of Warfare

Human computation is already taking an important place in modern warfare. From breaking up intelligence streams into pieces analyzed by thousands of people, to making key decisions in the ever-automated use of drones. For example, a drone may fly itself to an area of interest where a human operator makes a decision on what to target. This latter development, drones, and its extension into semi-automated robots is likely to bring about a significant shift in how war is waged and how participants experience conflict.

Drones provide many advantages to those using them. They greatly reduce the likelihood of casualties while providing better precision than indiscriminate use of bombing or artillery. In addition, they reduce the likelihood for mental illness associated with warfare since those controlling drones have less, if any, direct exposure to a high amount of violence.

On the negative side, drones and their robotic cousins make it much easier and less painful to enter into an armed conflict. With little risk for casualties, the human, financial, and political cost of war goes down. This approach to warfare also makes it easier for individuals to join the war effort. Driving to an office building to pilot drones or control robots is much less dangerous and life-changing than having to be deployed to a war zone. It also increases the distance between the drone pilot and those getting killed. As Lt. Col. Dave Grossman has mentioned, increasing physical distance makes it easier to kill (Grossman, 1996), as the stimuli that might trigger our empathy circuit is much less likely to be felt.

Future use of these weapons could further reduce the presence of empathy in these situations, in particular if drones and robots are further automated so they make their own decisions on who to kill. An alternative to drones and robots that make decisions based on sets of rules (Arkin,

2009) is to have human computation systems that bring more people in the loop to ensure that decisions to kill are well justified, and that the consequences of those decisions are known to those making decisions, and to the ones to whom they are accountable. In a democracy this would imply the right for citizens to know the human consequences of their country's actions in a war zone.

## 7 Conclusion

In this chapter we have discussed diverse ways in which human computation is currently affecting the likelihood of armed conflicts, and how it can impact de-escalation and recovery efforts. We have done this from the perspective that preventing, de-escalating, and recovering from armed conflicts is something to strive for, and that the opposite is not. We have touched on the likely future role of human computation in these areas. We have not intended to be exhaustive, but instead provide illustrative examples to lead to provocative discussions and to evoke ideas for future work. We have also tried to make clear that what matters the most is how human computation is used, and not so much what specific technologies are built.

Given our perspective, we believe human computation will yield the most positive results with respect to armed conflict when it is informed by research that helps us identify and mitigate factors that that make it more likely that armed conflict will occur, and to identify and strengthen the factors that make war less likely. In addition, human computation used to connect people in ways that engage the brain's empathy circuit will lower the possibility that those connections will lead to violence or to its recurrence.

The choices are there for us and for you on how to design the next generation of human computation systems, and how to use them. We invite you to think about peace when you consider these choices. Our world can be no brighter than the worlds we dream of.

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