Chapter 7

Ethical Considerations on the Use of Machine Translation and Crowdsourcing in Cascading Crises

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Abstract

When a sudden-onset emergency occurs, the language needs of those affected and those involved in the relief efforts cannot be foreseen. Provided that access to online communication is still available, it is not unlikely that many involved in the crisis will resort to language technologies such as machine translation and initiatives such as crowdsourcing to assist in the urgent need for multilingual communication. This may be done in an attempt to understand the key messages from official bodies, or relief organisations, when there is a lack of professional translators to assist in the multilingual communication process. This approach - machine translation and crowdsourcing - was successfully used in a previous crisis, i.e. the 2010 earthquake in Haiti. However, the use of technologies cannot be taken for granted. Even if they are supposedly used for good, a number of ethical issues should be given consideration before using these technologies, when using them, and in the aftermath of a crisis. In this chapter, we describe those issues by having a closer look at potential crisis translation workflows which rely on machine translation and crowdsourcing.

1. Introduction

Everyday thousands of documents are translated into different languages with one sole purpose: enabling multilingual communication. Depending on the purpose of such communication, the translations will be done by humans, computers, or a combination of both. In fact, with the advent of machine translation (MT) – i.e. translation automatically provided by a computer based on a training data set –, the door to multilingual communication has been opened to a wider spectrum of potential end-users. Nowadays, machine translation is used in professional translation workflows and personal communication alike. We contend that, if combined, machine translation and crowdsourcing can ensure a prompt reply and unlock the potentially huge bottleneck that could be caused by a lack of professional translators during crises.

In this chapter we will discuss the ethical issues that have to be addressed when designing a crisis translation workflow that integrates machine translation and crowdsourcing techniques. The overall aim is not to provide an axiomatic view of how to tackle these issues, but rather to enumerate them and raise awareness of their existence. In so-doing, we hope to supply future designers of crisis translation workflows with a reference list of issues to be taken into account. The chapter is structured as follows: we first evaluate the role of technologies in general and Information and Communication Technologies specifically in crisis situations (Section 2) and then we introduce our own vision of what crisis translation workflows availing (or not) of translation technologies could look like (Section 3). Section 4 delves into the different issues that arise from the proposed workflows. In Section 4.1 we focus on big data and artificial intelligence and in Section 4.2 we analyse how the ethical principles that have been proposed for AI/AS can be transposed to a crisis translation situation highlighting, where necessary, which additional challenges are at stake in each case.

Section 5 is devoted to the societal impact of crisis translation workflows and provides a summary of ethical considerations to be taken into account.

2. Information and Communication Technologies in Crisis Translation

In a crisis situation, access to information in the right language can save lives. However, and as reported by Kemp (2017, p. 4, her emphasis), 'for humanitarian organizations, that [access to information in the right language] can make minority language speakers some of the **most important people to reach** in an emergency – and **some of the hardest**'. For example, and as she further reports, 77% of the Rohingya refugees in Cox's Bazar lacked the information to make decisions for their families, and up to 62% of them were unable to speak to humanitarian providers. In the case of the West Africa Ebola outbreak in 2014, a myriad of languages was required. As also reported by Kemp (2017), while the official languages in Sierra Leone, Liberia, and Guinea are English (Sierra Leone and Liberia) and French (Guinea), very few of their inhabitants are actually fluent in those languages (e.g. 15-25% of the population of Guinea speaks French, and 20% of the population of Liberia speaks English). In fact, other languages such as Krio, Mende, and Themne, spoken respectively by 90%, 30% and 25% of the population of Sierra Leone, were required in the response to the Ebola outbreak. In the case of Guinea, the two most needed languages were Fula (32%) and Malinke (30%). Finally, 35% of the population of Liberia speaks Liberian (Pidgin) English. In such situations, translation becomes the key to unlocking communication issues, and MT can be used to accelerate multilingual communication. We will refer to these translation efforts carried out in the preparation and aftermath of a crisis situation as 'crisis translation'.[1]

Despite the fact that clear, accurate and timely information is essential in a crisis situation (Fischer, 1998; Seeger, 2006; Altay and Labonte, 2014), crisis translation is a relatively recent research field. In fact, and although there is research related to translation in war zones (e.g. Inghilleri, 2009; 2010; Baigorri-Jalón, 2011; Baker and Maier, 2011; Munro, 2013), little research has been done with regards to crisis translation needs that arise during sudden-onset emergencies, which may, or may not, involve conflict. This was already confirmed by Cadwell (2016) and Cadwell and O'Brien (2016), who additionally pointed out the limited evidence for research on the use of translation technologies in crises. In fact, although the role of Information and Communication Technologies (ICT) in disasters has been addressed elsewhere (e.g. Quintanilla and Goodfriend, 2012; IFRC, 2013; Munro, 2013), the first references to the role of translation technologies in crises refer to the 2010 Haiti Earthquake (Munro, 2010; Lewis, 2010; Hester *et al.*, 2010; Lewis *et al.*, 2011; Munro, 2013; Sutherlin, 2013).

Lewis (2010) and Munro (2010) report on the technologies addressed in this paper: MT and crowdsourcing techniques, respectively. Lewis (2010) reports on the efforts made by the Microsoft Translator team to release an MT system for Haitian Creole and English in 4 days, 17 hours and 30 minutes, which was subsequently improved over the following weeks and that helped in the disaster relief process. Munro (2010), on the other hand, explains how volunteer translators helped by means of crowdsourcing the translations as there was a shortage of professional translators who could assist in the disaster relief efforts. Both authors collaborated with Stephan Vogel on a paper that proposes a 'cookbook' for MT in crisis situations (Lewis, Munro, and Vogel, 2011). Their proposed cookbook consists of two main parts: the content and the infrastructure. With regards to the content, they propose creating a growing corpus of

data related to crises, using the English language as a pivot language and that could subsequently be used for training machine translation systems and providing assistance in future crises. While they do not discuss the ethical implications of collecting data (see Section 4 for our own take on this), they do mention the need to anonymize data emerging from crises before it is further stored and/or reused. As far as the infrastructure is concerned, they recommend a crowdsourcing micro-tasking infrastructure for translation, integrating the APIs from publicly available MT services such as Google Translate or Microsoft Translator, and a ready-to-go smart phone app that acts as a crisis Translation Memory[2] and that can be populated with content as it becomes available.

Assuming that there is internet access, one can also benefit from access to volunteers who are not in the region where the crisis has occurred but who have the required linguistic skills, despite not necessarily being professional translators.[3] This proved to be a key element in the assistance of the affected population of the Haiti earthquake in 2010, where the Haitian diaspora willingly volunteered to translate from Haitian Creole into English to facilitate the disaster relief operations (Munro, 2013). This kind of approach, by which tasks are distributed across a large number of people, is what is usually called crowdsourcing (Howe, 2006; European Commission, 2012), *a term coined by aggregating* 'crowd' plus 'outsourcing'. It has been used to create a public encyclopaedia, Wikipedia, available online and edited by any registered user. It has also been used in the past to improve systems such as optical character recognition systems (Von Ahn *et al.*, 2008) and has been the focus of attention in translation studies (e.g. O'Hagan, 2011; European Commission, 2012; Olohan, 2014). As proven by the success of the Haiti crisis disaster response (Hester *et al.*, 2010; Munro, 2013),

translation crowdsourcing can be used for good and to give assistance to those in need during a crisis.

Crowdsourcing has been used successfully in other crises for purposes other than translation. As reported by Munro (2013), following the 2010 floods that left millions of citizens homeless, Pakistani citizens established a platform called 'Pakreport' to report and map flood information. In the case of Haiti, Sutherlin (2013) additionally refers to a crowdsourcing platform that Haitian could use to access information or provide feedback on relief, which did not offer translation support. Cadwell and O'Brien (2016, p. 559) report how, in the aftermath of the 2011 Great East Japan earthquake, 'volunteers created a website called sinsai.info, which made use of the Ushahidi crisis-mapping software platform.' The map could display messages crawled from social media like Twitter using the GPS coordinates of those messages and translations availing of the Google Translate API. As they further report, one of the affected cities, Tsukuba, created a group of volunteer translators for English, Korean and Chinese to provide information to the large foreign population in that municipality. Other citizen-led crowdsourcing initiatives include the Christchurch Recovery Map established in the aftermath of the Christchurch earthquake in New Zealand, the Alabama Recovery Map, and the Oil Spill Crisis Map established in the US in the aftermath of a tornado and the BP oil-spill (see Munro, 2013). The citizen engagement in the aftermath of these crises indicates that crowdsourcing is, indeed, feasible in disaster relief and hence translation crowdsourcing could be a good way forward to ensure effective multilingual communication. But what are the ethical implications of involving the *crowd* in crisis translation? We will return to this in Section 4.

Finally, and while one can assume that these actions will be done in good faith, the use of technologies raises a number of issues that should be considered, particularly

from an ethical point of view. In the advent of the new 'Industrial Revolution' that the development of Artificial Intelligence and Autonomous Systems (AI/AS) has brought about, a renewed interest in revisiting their implementation and impact on society from an ethical point of view has emerged. Ethical issues related to AI/AS in general, and to the data used to train AI/AS, are currently being discussed by ethics researchers (e.g. Spiekermann, 2015; Floridi and Taddeo, 2016; O'Keefe and O'Brien, 2018; Wilton 2018), and as we shall see (cf. Section 4), the IEEE has recently published a series of principles that should govern the design and implementation of such systems. As rightly pointed out by Wilton (2018, p. 20), 'no technology is ethically neutral', but rather 'the consequence of a series of ethical decisions'. He further advises to consider the consequences and the principles of such systems and to think of their 'procedural accountability' (i.e. is it possible to produce evidence of how the ethical choices were made?).[4] In our specific case, i.e. crisis situations, issues such as selecting who has access to the crowdsourcing platform, how the data is distributed for translation, how sensitive data is handled, or what sort of support mechanisms will be available for the crowd need to be addressed before such a mechanism is put in place. The training of machine translation engines and the storage of previously translated data trigger similar ethical questions. Would it be legitimate, for instance, to store all data in case there is a new crisis that could benefit from it? If so, how will that data be stored and protected against potential threats like a cyber-attack? We will return to this in Section 4 but first we will introduce our vision of potential crisis translation workflows in order to illustrate how translation might be produced in such settings.

3. Crisis Translation Workflows Involving Machine Translation and Crowdsourcing

Translation has been experiencing shifting paradigms: from exclusively professional translators (with or without technology assistance such as the use of translation memories), to MT systems, or, recently in the industry sector, to crowdsourcing through distinct communities that may be paid (e.g., Unbabel[5]) or even unpaid (e.g. the volunteer translation of Massive Open Online Courses such as those on platforms like Coursera[6] and the like of TEDx talks, Olohan, 2014). These trends have often been portrayed as dichotomies: Humans **vs.** MT systems (e.g. Guerberof Arenas, 2009; see also Kenny 2019) or even professionals **vs.** non-professionals and/or volunteers (e.g. McDonough Dolmaya, 2011; O'Hagan, 2011; Olohan 2014). We contend, however, that all these new realities in the translation sector will play different roles in crisis translation situations depending on the stakeholders involved, and the technologies and infrastructure available (access to the Internet, availability of servers to train MT systems, previously trained MT systems on the same domains and/or language pairs, etc.).

In this section, we describe possible workflows in a crisis encompassing all the above-mentioned actors and also tackling the core aspect of how humans can leverage the output from an MT system in a sudden-onset emergency. It is, thus, our intention to build on the concept of the 'cookbook' mentioned above (Lewis *et al.*, 2011), to diversify as much as possible the recipes, according to the plethora of variables in a crisis. Figure 7.1 displays a holistic view of current translation workflows, notwithstanding whether they just involve translation without MT, MT without human post-editing, and MT with human post-editing with potential Quality Estimation in the loop. Figure 7.1 also highlights the modular structure of each of these potential

workflows, since each of the 'blocks' depicted can be used in isolation or be combined to increase the quality of the target texts and/or speed of their delivery.

When applied to crisis translation, and more specifically, translation during sudden-onset crises, we have grouped the possible flows into three main ones, acknowledging the various ways they can be implemented and highlighting the need to incorporate technology-assisted translation in order to provide a suitable and faster response. The first workflow encompasses scenarios where MT is not available and/or used. This workflow occurs when content is translated by humans (paid or unpaid) with distinct degrees of competences and experience in the field of translation. These actors are represented in Figure 7.1 under the generic umbrella term of 'translators'. When performing translation tasks, they may or may not avail of technologies (e.g. TM tools, concordancers, termbases,[7] etc.). A second workflow concerns the usage of machine translation, represented in Figure 7.1 in the first block. This second workflow may be used in a crisis situation to provide a faster dissemination of information to communities. In addition to the MT systems, and as an optional module, a Quality Estimation (QE) system can be used. The goal of a QE system is to automatically predict the quality of the translation produced by a system without having access to a reference translation (Blatz *et al.*, 2004; Specia *et al.*, 2009; 2013; Scarton and Specia, 2016; Martins *et al.*, 2017). This module would hence allow to filter 'good' and 'bad' translations in terms of accuracy. Depending on the set-up, this distinction could be used, for instance, to filter machine translation output that can be broadcast 'as is' (without human intervention), or that requires post-editing. The third flow encompasses MT and human post-editing and corresponds to all three blocks in Figure 7.1, again including an optional QE loop.

[INSERT “Figure 7.1” HERE]

Figure 7.1. Holistic view of current translation workflows.

In the following sections, we will consider the three main workflows we just described and, where needed, we will zoom in to better understand the main ethical concerns, in general terms, and in crisis situations, in particular. For space reasons, we will not tackle Adaptive Machine Translation[8] or Speech-to-Speech translation[9], both of which might also be applicable in crises. Transversal to all the workflows described below is the fact that the human intervention should also tackle quality-monitoring mechanisms to ensure the final quality of the translation and its adequacy for the cultural panorama of the affected communities. We will return to the association between risk and quality and its derived ethical considerations in Section 4.

3.1. Workflow 1: (Technology Assisted) Translation without MT

The first flow involves translation by communities of paid and unpaid translators (either professionals and/or volunteer translators) in situations where MT is not used. In this workflow there are four core aspects to consider: (1) the content and form of the source text to be translated; (2) the training of crowds of translators and the language pairs involved; (3) the quality of the target texts produced and the speed at which they are produced; and (4) the data and its reusability. The translators may have access to term bases and translation memories integrated in distinct Computer Assisted Translation tools.[10] This workflow can be framed as (Technology-Assisted) Translation and is crucial in a crisis situation.

Whenever possible, we advocate for involving professional translators in translation for crises. Such professional translators would constitute the best agents to take care of, whenever needed, data curation (e.g. data cleaning, quality assurance, etc.) and management as they are already used to these tasks in their professional life. They could also engage in the training of citizen translators for crises, a topic that has recently been addressed by Cadwell and Federici (2018), O'Hagan and Cadwell (2018), Cadwell *et al.* (2018) and O'Mathúna *et al.* (2019).

3.2. Workflow 2: Machine translation

The second workflow may encompass MT and, optionally, Quality Estimation (QE) systems. This workflow tackles firstly the data gathering for training the machine translation system, which in a crisis situation can be of various forms, such as tweets describing people's needs and status of the situation in remote areas, with potentially emotional tweets on the ongoing crisis (as described in Lewis, 2010; Lewis *et al.*, 2011 for the Haiti earthquake), or SMS sent to and from disaster relief organisations (e.g. the 4636 number used in Haiti), asking for help and providing information related to specific locations. In a second step, the source texts will be machine translated. In crisis situations where there is an urgent requirement to grasp the meaning of a message and rapidly assess people's needs the content could be machine translated only, in order to provide preliminary information for logistics.

MT output is nowadays mostly generated by neural MT (NMT) systems, sometimes providing fluent outputs, but still not fully accurate ones (Koehn and Knowles, 2017; Moorkens *et al.*, 2018). In order to improve the quality of the systems the main issue that will be faced is the lack of parallel data in the relevant languages, to adapt the system to specific content types or domains. Another possibility is to apply

quality estimation systems to assess the output of a translation system according to an empirically tested threshold (Scarton and Specia, 2016; Martins *et al.*, 2017), ranging from very conservative to preserve the quality of the output of the system, to more flexible, if the intention is merely to obtain a gist of the meaning. These thresholds can be established on a word or sentence-level basis. In the case of the word-level QE, each word is either 'good' or 'bad' in terms of accuracy according to previously trained post-edited data. In the case of the sentence-level QE, a sentence can be fully, mostly (e.g. 80-95%) or just partially accurate. The sensitivity of such thresholds usually requires human evaluation of the QE outputs and can be relatively adjusted to the purposes of the task. Therefore, if the QE estimation is above the defined threshold, then the text can be sent to end-users of the information. However, in a crisis situation, the quality requirement may be such that post-editing is necessary. This can be performed either by applying the quality estimation system and assigning the lower scored sentences to post-editors or by just sending the MT output directly to post-editors, bypassing the QE loop, as the arrows indicate in Figure 1. The data produced during editing could then be used by the MT and QE systems to further improve and adapt the models to specific contents or domains.

Open QE systems are becoming available[11] (Kepler *et al.*, 2019), but have not yet been applied in crisis situations. Furthermore, using MT only may be putting lives at risk, hence requiring the human intervention of post-editors, as will be described in the following subsection. Since in a crisis situation the quality of the information being provided must be assured in order to guarantee that no human life is at risk due to misleading or inaccurate information, the associated risk/quality of the information should be assessed and used to make clear decisions on which workflow to use.

3.3. Workflow 3: Machine translation and post-editing

The third workflow is the most complex one, since it encompasses all the above-mentioned workflows. It is a combination of MT, post-editing provided by paid/unpaid translators, with a possible QE loop. When technologies are available, we advocate for this third flow, since it allows for the provision of a faster response also assuring quality. This would be particularly beneficial to sudden-onset emergencies. Whenever possible, we advocate for using this machine translation assisted workflow. Assuming that the quality of the post-editing is good, this will ensure that the messages to be broadcast are properly understood. In a crisis situation, there are already translation workflows that could be used to answer the needs of the affected communities, either commercial or non-profit (e.g., Microsoft, Translators Without Borders, respectively).

Finally, it should also be highlighted that the proposed flows are not immune to several complex ethical considerations, which will be explored in the following section. We will focus on the singularities in terms of the ethical concerns posed by each workflow and on the general concerns about data, and especially on the idiosyncratic traits of data in a crisis.

4. Ethical Considerations on Data, AI, and Human Actors in Crisis Situations

The ethical dimensions of translation have been previously researched (for an overview, see Rawling and Wilson, 2019). Since data is the basis of both Statistical and Neural Machine Translation systems, the ethical concerns related to translation acquire new dimensions with MT usage. If before issues such as who is the copyright owner of the translations were discussed, now issues such as how existing or newly produced translations are used for training or tuning MT systems, where the data is stored, who retains ownership, and whether the data needs to be anonymized need to be considered

(e.g. Kenny, 2011; Moorkens and Lewis, 2019; Kenny, 2019). While one may take the view that Machine Translation systems are not autonomous systems (i.e., they do not make decisions by themselves), they do belong to that category of technology that would be considered Artificial Intelligence (in their training, algorithms such as neural networks are used). We therefore contend that AI principles would be applicable to our proposed translation workflow(s) for crisis translation. However, special care has to be taken, as crisis situations involve vulnerable communities; human actors in complex psychological situations providing logistic support of all sorts; and data with sensitive content resulting from the communication between many parties. Although it has been used before as a quick response to an urgent need, we do not advocate for using Machine Translation without human intervention at the time of writing, due to the intrinsic features of crisis situations and the fact that MT, despite its impressive development in the last few years, could still be considered an immature technology.

4.1. Ethical considerations on data and crisis

Artificial Intelligence is promoting the Fourth Industrial Revolution supported by the availability of Big Data, basically citizens' data available on the web or dedicated servers owned by public and/or private institutions – we term this Big (**our**) Data. This revolution is leading to hype on the expected results from AI in the near future (e.g. Hassan *et al.*, 2018) but also to ethical discussions (e.g. Floridi and Taddeo, 2016). The concerns and expectations brought about by AI are still to be fully discussed. The IEEE Global Initiative (2016) and Trancoso and Paiva (2018) are examples of efforts to tackle these issues, and EU-funded projects such as SATORI,[12] and SIENNA,[13] have been conducted to discuss and frame ethical considerations and AI. SATORI aims at developing a common European framework for ethical assessment of research and

innovation, and SIENNA aims at developing ethical protocols and codes for human genomics, human enhancement and AI & robotics.

Just as in any other technological revolutions, technology has been ahead of legislation and questions about Big (our) Data have been raised from a legislative perspective in the last few years. When the General Data Protection Regulation (GDPR - The European Parliament and The European Council 2016) came into force in May 2018, citizens were mesmerized by the amount of emails requesting their consent or review of data protection policies. This data has now become the gold of modern times. However, the way in which this data can be used, may lead to infringements of privacy. An example of this is how the coordinates of the US army locations in conflict zones were released by the fitness tracker they were using. Without being aware of it, the soldiers put themselves at risk when allowing their personal devices to access their GPS coordinates (Six, 2018; Untersinger, 2018). It will also need to be taken into consideration which legislation, if any, shall be observed at all times. Thus, if, for instance, any stakeholder is based in Europe, and personal data is collected in any form (e.g. translations, names of translators or other stakeholders, etc.) a new set of issues may emerge, as they would become data controllers and thus would be liable for any data breaches, as per the new GDPR. All these issues should be appropriately analysed and considered prior to putting any infrastructure in place (e.g. personal data could be duly anonymized, for instance by replacing names with placeholders such as [Name], prior to storing past translations, or reusing them to train MT systems).

In a crisis situation, it is possible that some of the information being translated will be of a very sensitive nature. Depending on the nature of the crisis, information may need to be spread to prevent further damage. This could be the case, for instance, when trying to avoid the spread of a deadly disease (O'Brien and Cadwell, 2017), or

when releasing information on how to remain safe is key. Along with the translated texts, metadata such as when the text was translated, by whom, and maybe even from which IP address will be possibly shared amongst the different stakeholders, and it is therefore of utmost importance that these issues are taken into account when designing crisis translation workflows. Issues such as who has access to the data, who is the data curator and manager, how is the data processed and where and how it is stored are key prior to establishing any translation workflow to ensure that all parties are protected from potential data and privacy breaches, or even potential threats like cyberattacks (for instance, all data could be anonymized, whenever possible, and encrypted to avoid data breaches should this happen).

One way of preserving a citizen's privacy would be using data anonymisation techniques, which in fact have increasingly been used to this effect. This is also what Lewis *et al.* (2011) recommended in their crisis translation cookbook, although they did not delve into details as to how to accomplish this. However, as stated by Lubarsky (2017) and Wilton (2018), when aggregating information from different sources, data anonymisation may fail, resulting in reidentification of personal data distributed across different data sets. This would be the case, for instance, when different anonymized datasets are aggregated and in this process data that on its own may not have allowed for the identification of people, then allows for it (e.g. one may not be able to identify a person based on their gender, city of residence and age range but if additional data is revealed, like their ethnicity, religion or civil status, it may be possible to single out who that person is). This could be a highly problematic issue in a crisis situation, where the leakage of data from citizens or other stakeholders (e.g. volunteers) may cause irreversible outcomes should their integrity get compromised as a result of such breach. Therefore, adequate mechanisms should be put in place to protect all stakeholders

involved in the data sharing process: affected citizens, volunteers, responders, etc. One such mechanism could be to assign pseudonyms or placeholders to the names of volunteers so that they cannot be identified in the case of a terrorist attack, for instance, where the terrorists may have an interest in identifying those who helped against their cause and threaten them or their relatives.

The ethical concerns associated with data are, thus, not fully recognized and seem to be corseted into data anonymisation. It does not seem to be a balanced equation: on one side, big data, cloud systems, various platforms, and on the other side, *fragile* anonymisation. *Fragile* in the sense that there is no state-of-the-art system able to fully automatically replace Named Entities (person name, location, alphanumeric information on ids, passwords, credit card numbers, etc.), the core nucleus of an anonymisation service, by placeholders. This should be taken into consideration in crisis situations, since automatic anonymisation techniques are still not fully matured. In fact, distributing sensitive content that should be fully anonymized to a crowd of volunteer translators may also trigger concerns, even if *Non-Disclosure Agreements* are signed previously between the volunteers and the organisations coordinating translation efforts, or other stakeholders involved.

One of the core questions is thus, *who are the stakeholders involved in data processing and management?* It should be considered that data is in all the steps of a translation workflow, and that in each step it may be transformed, it may grow by aggregation, or it may be processed by the different systems in each module. Additionally, different stakeholders (translators, disaster relief agents onsite and offsite, engineers, etc.) will have access to such data, and in some cases will additionally be able to manipulate, or store it. Where and how the data is stored will also raise new concerns (e.g. a personal computer, a server in the cloud, computers or devices

pertaining to public or private institutions, etc.). The stakeholders need to be conscious of the data they are working with and may have to face moral decisions when tackling data (e.g. can the data be shared across organisations without infringing the privacy of those involved?).

Ultimately, it will be an individual decision to respect any agreements made, or to abide by a code of ethics, and a trust relation between all stakeholders, particularly in cases where the lack of time may force overriding protocols in order to save lives (e.g. recruiting a translator on time). It is important to also highlight the need to protect the crowd (be it professional or citizen translators), from potential post-traumatic stress disorder (e.g. Nsiah-Kumi, 2008; Hawkins *et al.*, 2009; Newman *et al.*, 2009; Greenstone, 2010). Volunteer translators should also have access to any mechanisms available to other stakeholders, should they need to avail of them. Training MT systems requires parallel corpora. This may be translation memories (TWB, for instance use a TM platform for some of their work) or available data that has been previously translated. There are two main considerations in this regard: ownership of the data, and curation. With regards to ownership, Moorkens and Lewis (2019) propose that all actors involved in the translation process have a shared ownership of such translation when discussing the copyright issues involved in the (re)usability of trained models to build MT systems. In a crisis situation involving crowdsourcing, this shared ownership may not be a viable possibility. However, the contribution by the crowd should be acknowledged. As far as data curation is concerned, mechanisms have to be put in place to ensure that sensitive information is encrypted or deleted to avoid potential personal data breaches.

Another important issue to be taken into consideration is data quality. This will depend on the provenance of the data used to train the initial MT systems, but also on

the quality of the translations produced by the translators, as these will likely be used to retrain the systems and, hopefully, improve system quality. This quality debate is not specific to crisis situations. As previously stated in Section 3, the quality of the data produced by humans has a direct impact on the quality of the systems. In our context, quality is of utmost importance, as a translation error may put someone's life at risk and mechanisms should be put in place to mitigate the risk as much as possible. Translation quality is a very broad topic and hence it is not our intention to establish here any quality monitoring guidelines. In each crisis situation, the quality monitoring workflow will need to be carefully designed and agreed upon. We do recommend recruiting professional translators and/or editors as quality controllers, whenever possible, or, when engaging with the crowd obtaining several post-edits for what may be highly sensitive data as a way of triangulating quality and minimising risks. Another possibility would be to start Translation Quality Assurance (TQA) processes as early as the deployment of MT systems and perform evaluations where translators are asked to select which system is producing better quality translations. This strategy would be particularly useful from a crisis preparedness perspective, as then quality assessed MT systems would already be at hand in the case of a crisis situation. That is: depending on the time pressure and translation needs, different TQA protocols can be established at each step of the workflow. While it will not always be realistic to have a fully-fledged TQA workflow in place, those involved in a crisis will have to determine the best strategy for mitigating potential quality issues.

Finally, and as also suggested by Lewis *et al*. (2011), the data produced in one crisis may be stored for future ones. In our case, this may imply the corpora with the source and translated texts, but also the machine translation systems and their respective components (e.g. data used for training and testing the models, translation models and

parameters used, or even translation tables in the case of SMT systems). Reusability of data for knowledge transfer from one crisis to another could be very useful, since it would allow for preparedness to new sudden-onset emergencies instead of just reaction. However, in terms of ethical concerns, it also triggers questions (e.g. how will the data be encrypted and protected against potential data breaches? Who would be accountable in the event of a data breach? How can the data be accessed if there is no common platform and it is stored in private servers from specific organisations? etc.), since adaptation to a new crisis may involve different actors from the previous ones and different targeted communities. As far as translation is concerned, we believe that there are still many lessons to be learned to understand the full impact of knowledge transfer from one crisis to another.

4.2. AI Principles and Implications for Crises

In December 2016, the IEEE Global Initiative published the first version of their 'Ethically Aligned Design' paper with the aim of encouraging technologists to prioritize ethical considerations in the creation of autonomous and intelligent technologies (The IEEE Global Initiative for Ethical Considerations in Artificial Intelligence and Autonomous Systems 2016). The four principles, (1) Human Benefit, (2) Responsibility, (3) Transparency and (4) Education and Awareness, address issues for AI/AS, and were proposed based on three premises: (1) they should embody the highest ideals of human rights, (2) they should prioritize the maximum benefit to humanity and the natural environment, and (3) they should mitigate risks and negative impacts as AI/AS evolve as socio-technical systems. In what follows, we briefly summarize each of the proposed principles and consider how they apply to crisis translation workflows.

4.2.1. Human Benefit

The first principle advocates for the development of AI/AS systems that do not infringe human rights. More concretely, in order to observe this principle, the following recommendations are made:

1. AI/AS should be designed and operated in a way that respects human rights, freedoms, human dignity, and cultural diversity.
2. AI/AS must be verifiably safe and secure throughout the operational lifetime.
3. If an AI/AS causes harm it must always be possible to discover the root cause (traceability) for said harm. (The IEEE Global Initiative for Ethical Considerations in Artificial Intelligence and Autonomous Systems, 2016, p. 16)

In our context, this means that any MT technology and crowdsourcing techniques used for disaster relief should observe the Universal Declaration of Human Rights (UN General Assembly, 1948), which in principle they will, as the main aim is to enhance multilingual communication and in so-doing there will be no discrimination on the basis of cultural or linguistic differences. It also means that the infrastructure deployed must be secure, and that all steps should be traceable. This implies having the capability to trace who was responsible for a translation error, or even where in the MT system a translation issue (e.g. mistranslations, omissions, additions, etc.) is generated. Depending on the type of MT system deployed, however, this may not always be possible. In the case of (NMT systems, for instance, it is nowadays not possible to trace the origin of a particular translation, while in the case of SMT this could be done to a certain extent by consulting the translation tables and their probabilities. The way in which NMT systems make decisions and how to interpret and influence their intrinsic layers to shape future translation outputs are an emerging topic, with growing awareness within the research and industry communities. Although progress has been made in creating awareness for such issues, the fact that not all MT systems are fully traceable

implies that this IEEE recommendation cannot be fully met at this stage and hence those availing of MT services for crisis response should be aware of this potential issue.

This topic could also pertain to the Transparency principle listed below. As Stephen Hawking wisely said at Web Summit 2017, AI technologies should serve humanity, therefore human benefit should always be the core principle to follow. Moreover, as also stated by the physicist, at this stage 'we just don't know' what AI can bring to humanity, we need to be 'prepared and avoid potential risks' (Hawking, 2017).

4.2.2. Responsibility

This principle aims at ensuring that AI/AS are accountable. It is based on the fact that the general public usually avails of AI/AS, while the programming and output of the latter is usually not discernible for them. The document provides a series of recommendations as to how AI/AS can be made accountable. These include (1) advocating for legislation to cover the development and deployment of such systems, including issues such as responsibility, culpability, liability, and accountability; (2) taking into account cultural diversity in the deployment of AI/AS, (3) creating multi-stakeholder ecosystems, and (4) registering key, high-level parameters such as intended use, training data, algorithms, etc.

In our specific case, this could be achieved by actively lobbying for legislation that covers AI/AS for disaster situations by (1) taking into account, as discussed earlier, the different cultures and stakeholders involved in a crisis situation and (2) integrating all stakeholders (volunteers, professional translators, members of disaster relief organisations, etc.) into a common translation framework for disaster situations and ensuring they all work together and are aware of the translation workflow and what

each step entails and (3) by duly documenting the setting up of the infrastructure for the translation workflow(s).

4.2.3. Transparency

The transparency principle aims at ensuring that AI/AS are clear and explainable, i.e. it should be possible to know how and why the system made a particular decision. This principle is essential to build public confidence in the technology, to make sure that citizens trust the systems they are using. As stated before, NMT systems are known to be black boxes (e.g. Kenny, 2019) providing outputs without explicit knowledge on how the output has been selected. A possible example of this transposed to our setting is to make the output of the MT systems or the QE system clear and understandable to all the users, so that an emergency response organisation can understand why some text is being machine translated and other text is being routed to a translator and/or volunteer. The relevant stakeholders should be involved in the process of establishing the thresholds and scores to be used (for QE, for instance) and assess them in terms of quality risks. Being transparent will not only ensure better and more effective communication for all the actors involved, but will also allow them to work as a team and understand their role and that of the technologies assisting them in the process of providing disaster relief.

4.2.4. Education and awareness

This principle aims at extending the benefits of AI/AS while minimising the risks of technologies being misused. As the IEEE authors rightly point out, as AI/AS become available, it is important to educate citizens not only in their use, but also in the risks associated with their misuse, such as hacking, or 'gaming' the system. They propose to (1) provide ethics education and security awareness, (2) deliver education in new ways

(e.g. via social media), and (3) educate law enforcement surrounding these issues so that fear and confusion is avoided as citizens work collaboratively with the providers of the AI/AS.

This principle is strictly linked to the need to train, on the one hand the local, national and international response organisations so that their choice of using MT and QE systems is an informed one, and citizen translators on the other (on this topic, see Federici and Cadwell, 2018; O'Hagan and Cadwell, 2018; Cadwell, Federici, and O'Brien, 2018). Transposed to our specific topic of interest, all stakeholders involved in the translation workflow need to be trained on how MT systems work, and how the infrastructure has been implemented to allow for crowdsourcing translation, if they are not already acquainted with these topics.

5. Conclusion

In this chapter we have attempted to highlight the ethical considerations that should be considered when deploying crisis translation workflows involving the use of technologies such as machine translation and crowdsourcing techniques. We have done so by first highlighting how a crisis translation workflow may vary from one crisis to the next, as their realities will not always be the same, and then focusing on the various issues encountered when dealing with both the data collected and generated in crisis translation workflows and the human side of the actors involved.

We contend that the best of AI systems augmented by human editing will allow for the **assistance** of human beings in diverse crisis situations. We also contend that to ensure the balance between AI systems and human beings the IEEE principles should be applied. As advocated earlier, from our point of view, it will not always be feasible to engage professional translators only to provide the necessary multilingual

communication in disaster relief. Moreover, engaging citizen volunteers may prove to be useful for understanding the particular cultural and local needs related to any crisis. This will depend greatly on the language pairs involved and on who is available. In our specific case, we hold that resorting to volunteer translators is justified by the situation, but special care should be given to the ethical issues that this brings about, including ways of protecting them from potential post-traumatic stress disorder. O'Mathúna *et al.* (2019) cover this issue in more detail. Our overall recommendation, however, would be to engage professional translators whenever possible, and use their professional expertise as coordinators of the translation task and quality assurers.

AI-technologies need to continuously be discussed and legislated for. Citizens have the right to be informed and transparent processes are needed, even more so due to the immature phase that AI is in right now. Automatic methods will continuously be updated. Throughout this chapter, we have outlined some of the ethical concerns that might arise due to AI usage in general and we have also contextualized them in a crisis translation setting. Our intention is that our contribution will help those involved in deploying such infrastructures to take informed decisions.

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[1] Although sometimes the term 'crisis translation' is used as a generic umbrella term for both translation and interpreting in crisis scenarios, in our paper we focus solely on written translation tasks that may undergo machine translation and/or human translation or post-editing.

[2] A Translation Memory is a database of previous translations. It is usually integrated in the so-called Computer Assisted Translation tools and helps translators to increase their productivity by automatically retrieving past translations for source sentences that are identical or similar to the source sentence to be translated at each point.

[3] It should be noted that by no means the intention of the authors is to suggest that MT can be used as a substitute for human translators. However, with MT becoming a reality in the translation industry, we advocate for its responsible use in crises, as it could significantly speed up the process of broadcasting information in the right language and hence save lives.

[4] For the purposes of this paper, we use the definition of ethics by Crisp (2011, n.p.) : 'the systems of value and custom instantiated in the lives of particular groups of human beings', in particular '"morality", which involves notions such as rightness and wrongness, guilt and shame, and so on'.

[5] See https://unbabel.com.

[6] See https://translate-coursera.org.

[7] While glossaries and termbases can be very useful in a translation task, it should be noted that in crisis situations they may be hard to obtain or create if they are not already available. In such cases, we recommend that such materials are prepared before and foremost, in

preparation for potential crises, and, when not available beforehand, during and after the crisis situation, as they could be very valuable materials to be prepared for future crises.

[8] Translations produced by MT systems with on-the-fly adaptations to users' productions by providing alternatives whenever a word is written. It is a method similar to autocomplete and it is usually defined as an assistive technology which promotes faster translations.

[9] Speech to Speech translations refers to the technology whereby sentences spoken in one language are translated to another language in real time. For an overview of idiosyncratic voice related ethical concerns see (Trancoso and Paiva, 2018).

[10] Computer Assisted Translation tools encompass Translation Memories and term bases. These tools may indeed constitute very valuable sources of data for training the MT systems, but due to space restrictions, they will not be described in detail. The ethical considerations that relate to them will be mentioned, as they would be the same as those related to data management.

[11] See https://github.com/Unbabel/OpenKiwi.

[12] See http://satoriproject.eu.

[13] See http://www.sienna-project.eu.