Translating Hazards: Multilingual Concerns in Risk and Emergency Communication

Hazards are natural, technological, biochemical, and human-led. Hazards expose communities to specific threats and risks. Triggered by hazards, disasters are the worst manifestations and actuations of potential risks. In fact, the distinction between risks and hazards is crucial for translation and interpreting research: 'there is a consensus among national and international institutions that a hazard describes a potential for harm and risk the probability that such harm will occur for a specific target' (Scheer et al. 2014, 1275). Vulnerability is the term used to indicate the capacity of individuals or groups to deal with the exposure to and impact of disasters. These terms in English are subject to technical and scientific debates (e.g., Kelman 2020; Pescaroli and Alexander 2016; Gaillard 2019; Gierlach, Belsher, and Beutler 2010) and terminological reassessments (Chmutina and Von Meding 2019; Chmutina, Von Meding, and Bosher 2019). Debates around preventative measures against hazards worsened by continued reliance on fossil fuels are quickly coloured by corporate lobbying, especially around time available to reverse the effects of climate change, which increases hazards and the magnitude of disasters (Gaillard 2010; Almiron 2019). The relationships between hazards and risks takes centre stage in political rebuttals of the impact of climate change on the scale of destruction caused by the hazards. Core terms such as hazards and vulnerability are no longer transparently comprehensible nor easily translatable; yet hazards affect everybody on the planet. The severity of impact of natural hazards on a global scale can no longer be ignored – not that it should have ever been ignored. Without even engaging with malicious misinformation (Dunlap and Brulle 2020) and negationist counternarratives, the problem begins with having access to these very terms and the preventative practices on disaster rirsk reduction, so as to be prepared when disasters occur and multilingual communication in the response phase becomes a weak link among the many dependancies of emergency planning. Understanding hazards and risks ought to happen through channels, languages, means, and formats to which people have access, especially in densely populated multilingual regions exposed to hazards. Understanding the relationship between extreme multi-hazard events and climate change is a priority for efficient multilingual crisis communication, and is essential to educate at risk people about the local hazards and develop their own resilience, as well as contributing to enhancing the existing knowledge base around hazards.

Interpreters and translators regularly work to communicate hazards so that the recipients of information can take informed decisions when preparing to mitigate the impact of hazards. Sharing knowledge around hazards depends on having access to scientific papers, reports, and terminological resources in multiple languages. The work of translators and interpreters arguably depends on the

domain-specific terminological resources and availability of highly proficient speakers of multiple languages, who have been trained to be translators and interpreters. However, these conditions are not always there. As translation is intended broadly in all its multimodal facets, including audiovisual translation, sign language, interpreting, I will often refer to multilingual communication – a term emerging from practices in humanitarian and crisis response sectors. Translation is key to participating in debates around hazards and risks, as academic studies need to collect more data (using translations from local languages) and need to be translated in more languages (enabling knowledge sharing). Multilingual communication often depends on developing services where none are available, relying on anything from spontaneous initiatives (which have merits, as shown in Cadwell, 2014, 2015; Cadwell & O'Brien, 2016) to more concerted modes of citizen translation (Federici & Cadwell, 2018). They all contribute to higher levels of understanding, encouraging better preparedness to face and deal with hazards; however multilingual communication concerning hazards connected to climate change needs a lot more than these actions. There is a necessity to create ecosystems of preparedness that recognize language as a crucial tool to introduce the debate around the local and global hazards (Federici, O'Hagan, et al. 2021). Such ecosystems could build on the growing networks involving scientific experts, professional translators and interpreters alongside institutions and civil society organizations that coordinate large-scale campaigns of information around hazards.

Introducing the conceptual challenges of translating hazards, this article opens a special issue focused on multiple facets of multilingual risk communication. Subdivided into three sections, this article discusses factors that can shape research into translating hazards. The first section considers relationships between definitions and key conceptualizations in the global disaster risk reduction agenda that create terminological barriers to shaping a broader public understanding of local hazards, often among populations exposed to higher levels of risk. The second section reflects on studies and approaches that consider multilingualism and risk communication practices around hazards in relation to preparedness. The third section illustrates how key grey literature deems multilingual risk communication important while it struggles to reconcile the need to exploit existing technologies to enhance resources for multilingual communication, with the absolute need for trust in the information. The conclusions are followed by a list of references intended to draw the readers' attention to some of the key perspectives that can stimulate future research focused on translating hazards.

1 Hazards and People

Hazards bring destruction, upheaval, and death when they trigger disasters, whose cascading effect can embroil multilingual populations in long-lasting crises. Regional problems promptly become

intercontinental problems, their cascading impact affecting ever large geographical regions and posing risk for people regardless of national boundaries (Clarke et al. 2022). Despite this, local knowledge of hazards and their increasingly interconnected risks lags behind, because translations of local knowledge, data, and evidence into international scientific languages lags behind.

Cross-cultural differences colour risk perceptions (Gierlach, Belsher, and Beutler 2010; Davis 2015; Cornia, Dressel, and Pfeil 2014; Rogers and Pearce 2013; Wray et al. 2006; Ropeik 2002) and emotive and cognitive responses, steeped in socio-cultural values, condition risk perception (Ponari et al. 2015). Humans avoid taking risks, or engage with risks, because of our evolutionary adaptive abilities – humans adapt to the environment and adapt the environment to themselves (the 'adaptive capacity' in Birkmann et al. 2013, 196-197). If on the one hand, the anatomical dimension of emotions and pains – the biochemical reactions that they generate – are universal for all humans (Volynets et al. 2019), manifestations and reactions to fear, anger, frustration are culture-bound and expressed in taboo-restrained expressions. Slovic and Peters (2006, 323) note that 'people judge a risk not only by what they think about it but also by how they feel about it', and we interact with risks in culture-specific ways (Appleby-Arnold et al. 2018; Cornia, Dressel, and Pfeil 2014; Douglas and Wildavsky 1983; Paton 2016). Humans frequently underestimate certain risks and over-estimate others. Communicating risks to people, properties, and places is an act that relates to security and safety, if it is done in a language that they understand.

Additionally, interconnectivity coexists in socio-economic environments strained by serious inequalities and divides, especially in relation to having access to information. The 21st-century version of our resilient yet selfish species, the *homo sapiens*, has reached peaks of interconnectivity that enable immediate communication and cross-boundaries instantaneous trading. Commercial and cultural exchanges can proceed at unprecedented speed; for those with the financial means, travelling across vast spaces is also fast and easy. The perception of *time* has changed but the divide between those who can *feel* the immediacy of changes and those who cannot has increased. Time has been compressed by the speed of communication and the technological advancements in travels; however, as Cronin has argued for two decades (Cronin 2003, 2017, 2013), the speed of interactions does not erase local differences, values, and cultures. In this context, economic divides perpetuate historical power imbalances, and these are visible in the availability of professional translation and interpreting services in a very limited number of language combinations, compared to the thousands of combinations needed among the 7,000 languages still spoken. It comes as no surprise therefore that translation and interpreting of local knowledge and expertise regarding hazards, in fact, does not benefit from the communication speed of other sectors. There are multiple calls from academics (Gaillard 2019; J.R. Cadag 2022; Chmutina et

al. 2021) and organizations (IFRC 2021) to provide communities with the terminological and technological tools to share their risk reduction strategies in ways that improve, challenge, and integrate current technical discourse and terminology.

For the discussion of hazards however, multilingual communication for communities outside the wealthy countries (and often for marginalised communities within wealthy countries) does not benefit from extensive technological resources. In terms of translation technologies, not all languages are equal and certainly seeking specific information about local hazards in one's own language during a disaster or to be better prepared to face the exposure to hazards is not easy for all residents. The demand for absolute immediacy dictated by the urgency of responding to the threats unleashed by hazards is affected by the many limitations of available language resources, even before we consider budget limitations to deploy such resources. The inequality of multilingual communication in relation to hazard lies in the lack of resources for low-resource languages (Haddow et al. 2022). From this perspective of unequal means, three concepts deserve attention for their roles in influencing terminology, action, and discourse: hazards, cascading crisis, and vulnerability. A succinct discussion of these terms is necessary because their use pervades international rescue operations, climate change preparedness activities, development activities, and the activities of the international humanitarian sector. Their codification at times enables local governments to have access to additional funds (e.g., 'state of emergency') and to activate special legislative powers (e.g., 'public health measures'). Limited translation accuracy out of English of some of these terms causes delays and barriers to action (Guadagno and Matthews 2023; Otaki and Chai 2018), additional morbidities (Ferris 2017; Field 2017) and higher mortality rates (Hines et al. 2014), or, in the case of vulnerability, reticence to eradicate with culturally inappropriate rescue and recovery paradigms (Gaillard 2019; J.R.D. Cadag 2019; Tesseur et al. 2022)

I.I Hazard

For the United Nations Office for Disaster Risk Reduction, hazard is defined as a 'process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation' (UNDRR 2015, 15). The technical glossary, the *Hazard Definition and Classification Review* (2020), lists over 300 hazard types and the search for a 'standardised language for impacts and risk' (Clarke et al. 2022, p. 15) is a need also associated to 'building capacity for local experts' to assess risks and educate populations about local hazards.

In fact, the United Nations set out an agenda to address the interlocking effects of the climate crisis and the increased impact of hazards: the Sendai Framework of Risk Reduction 2015-2030 (UNDRR, 2015). The Framework pursues one outcome: 'the substantial reduction of disaster risk and losses in lives, livelihoods, and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries' (2015, p. 12). Together with the 17 Sustainable Development Goals (SDGs) agenda and the Paris Agreement, the Sendai Framework's success depends on concerted international actions that ought not to stifle sustainable development while increasing preparedness and resilience to face hazards. The Sendai Framework has now reached the half-way point of its 2015-2030 agenda and the most recent annual evaluation of progress, the *Global Assessment Report on Disaster Risk Reduction* (2022), makes promising steps forward regarding multilingual risk communication. The report considers how two years of pandemic, severe weather events, and multi-hazards disasters have proven that systemic approaches that consider local knowledge have to come to the fore (UNDRR 2022, 78-91). Arguably, measuring the success of the Framework rests on how it manages to shift its initial approaches to understanding ecological-social risks away from traditional, often top-down only, decision-making processes.

The 2022 report recommends to continue on the road of different 'possibilities to use and create new polycultural and transcontextual knowledges and to apply them in practice' (UNDRR 2022, 91). In fact, it envisages more participative practices as essential to pursue its risk reduction goals. This fundamental shift may transmute current disaster risk reduction paradigms centred around *sharing and providing* information to more inclusive ones centred around *having access to information*, thus including the right to ask for, demand, and contribute to acquiring and growing locally relevant knowledge. This form of community engagement encourages an understanding of hazards and risk reduction as dependent on multilingual communication through 'polycultural and transcontextual knowledges' relying on 'governmental and scientific experts intent on working with communities to "translate" the systemic nature of risk and scientific data for use with and by a range of groups' (UNDRR 2022, 91). The 2022 *Global Assessment Report* recommends innovative ways forward dealing with hazards which may lead to plan and prepare *with* local multilingual communities, rather than *for* them. This shift may entail that T&I researchers, professionals, and advocates for multilingual communication of hazards ready themselves to meet the unmatched, extraordinary urgency of translating facts, evidence, terminology, and every other possible kind of information to change narratives and create relational approaches to disaster risk reduction. Such a high-level shift in perspective demands that local and global hazards are understood in abstraction but also that local knowledge can contribute to enhancing global practices for disaster risk reduction.

1.2 Disaster

In this international agenda, another term charged with different cultural and socio-economic connotations is the term 'disaster' itself. The UNDRR defines disaster as a 'serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability, and capacity, leading to one or more of the following: human, material, economic and environmental impacts' (UNDRR, 2016, n.p.). From the perspective of emergency planning, disasters are categorized according to their magnitude and impact in relation to the response they demand, as represented in Table 1. Any large-scale cross-border, or international disasters have an impact on populations that speak multiple languages. By their very nature, disasters have far-reaching consequences, whose 'initial impact can trigger other phenomena that lead to consequences with significant magnitudes' (Pescaroli and Alexander 2015, 65). Local populations can therefore advocate for their needs, and become more resilient, not as a way for local political authorities and institutions to shift the blame for poor planning to at-risk populations, but rather to engender better practices that benefit themselves, their families, and their communities first.

In Table 1, I add the emphases on multilingual communication needs as evidenced in academic research (O'Brien and Federici 2023a; Chmutina et al. 2021) and grey literature (IFRC 2021, 2018).

	Incident	*Major Incident*	*Disaster*	*Catastrophe*
Impact	Very localized	Generally localized	Widespread and severe	Extremely large
Response	Local efforts	Some mutual assistance	Intergovernmental response	Major international response
Plans and procedures	Standard operating procedures (SOPs)	Emergency plan activated	Emergency plans fully activated	Plans potentially overwhelmed
Resources	Local resources	Some outside assistance	Interregional transfer of resources	Local resources overwhelmed
Public involvement	Very little involvement	Mainly not involved	Extensively involved	Fully involved
Recovery	Very few challenges	Few challenges	Major challenges	Massive challenges
Multilingual communication needs	Probable	Highly probable	Certain	Overwhelming

Table 1. Categorization of events by size, process, and impact in relation to emergency response. Adapted from Tierney (2008), discussed in Alexander (2016). Adapted by Federici to suggest how multilingual crisis communication should be embedded in this synoptic overview of the scale of disasters.

In Federici and O'Brien, we made the case for using *cascading crises* to study the long-term impact of disasters in multilingual contexts, considering that '[n]ot only are crisis situations disruptive events that occur at a specific time, in a specific region, to identifiable groups of people, but crises also have cascading effects on surrounding societies and regions, immediately and over time' (Federici and O'Brien (2020, 2). The centrality of effective multilingual communication appropriate to local cultures, languages, and societies deserves to be studied not only at the outset of a disaster (the response phase), but in relation to what needs to be done to increase resilience and preparedness against local hazards. The latter depend on individuals' perception of the risks caused by the local hazards, but organizations also need measurements of the potential impact of disasters to set up appropriate emergency plans, using categorizations such as those in Table 1. In short, risk perception is culture-specific, but disaster risks have been measured quantitatively for a decade, so as to work out universal parameters that can be localised reflecting local needs in emergency plans and long-term strategies to increase preparedness. Disaster risk is calculated according to Welle and Birkman's equation (2015):

$$\text{Disaster Risk (R)} = \frac{\text{Hazard(H) x Exposure (E) x Vulnerability (V)}}{\text{Coping Capacity (C)}}$$

The metrics represents a point of departure to assess risks locally, so that international entities (UN and international NGOs, corporate partners, etc.) can prioritise action plans designed by and agreed with local governments. Used for over a decade, the index 'stresses that risk is essentially determined by the structure, processes and framework conditions within a society that can be affected by natural hazards, as well as the exposure to natural hazards and climate change' (Birkmann et al. 2011, 14). The metrics generate the WorldRiskIndex (Welle and Birkmann 2015). Some components are self-explanatory, exposure refers to the number and types of (natural) hazards affecting a place; some components are multi-factor, for instance coping capacity refers to the infrastructure to deal with disasters, from emergency services via healthcare capacity to legislation. The WorldRiskIndex's measurements are discussed at the Intergovernmental Panel on Climate Change (IPCC) and have been used since their inception at the annual Conference of Parties (COP). The most exposed countries on the index also tend to be the most multilingual countries and those with limited healthcare capacity; language is also a social determinant of health and a core factor in determining vulnerability – itself a multi-layered factor. Despite evidence in the disaster literature that inaccurate communication may constitute a contributing factor in (temporary) increasing and compounding vulnerabilities, multilingualism however is not explicitly measured.

I.3 Vulnerability

Vulnerability, the term used to indicate the capacity to deal with the impact of disasters, is a key component in relation to language and multilingual communication. Alexander (2013, p. 980) offers a widely accepted definition: 'Vulnerability represents the potential harm incurred by a person, asset, activity or assemblage of items that is at risk'. It is very important to distinguish how the hazards and risks are not absolute and predetermined in disaster, but a potential outcome in which the risk 'is mainly the result of social, economic, political, and cultural factors in decision making, vulnerability is constructed socially' (Alexander 2013, 980). Furthermore, Alexander continues to distinguish six types of vulnerability (2013, 982):

1. Economic: people lack adequate occupation.
2. Technological (or technocratic): caused by the riskiness of technology.
3. Residual: caused by lack of modernization.
4. Delinquent: caused by corruption, negligence, etc.
5. Newly generated: caused by changes in circumstances.
6. Total: life is generally precarious.

Furthermore, Cannon (2008) emphasises the need for cultural understanding of disasters and local understanding of resilient practices; communication of risks and having access to relevant information make language groups more or less resilient. Examples of delinquent vulnerability abound; lack of planning to support multilingual communication when there is extensive evidence that is needed is one of its manifestations. Short-termism over immediate needs in the response phase overshadows continued long-term support for resilience (Easthope 2022), which in many contexts continues to require interpreting for trauma in recovery (Kirmayer, Bennegadi, and Kastrup 2016)

When revising this article, there was a clear example of socially constructed vulnerability. A major flood caused a disaster on the island of Ischia, in Italy; it killed families, children, and destroyed houses and properties. The disaster was caused by a multi-hazard event: high daily rainfall (a weather-related hazard) caused flooding (a natural hazard), that triggered a landslide, becoming a multi-hazard event. The landslide destroyed many properties on the most affected hillside; many of these properties had been erected illegally against local planning regulations over the years and had then been granted retrospective pardons, which allow inhabiting illegal buildings that are difficult to protect and insure (Gizzi, Porrini, and De Masi 2021). This is an example of the relationship between vulnerability and natural hazards (heavy rain and flooding), which trigger local geomorphological risks (landslides and

tremors), heightened by climate change (intensity and duration) testing local capacity (emergency services arrived quickly, but the islanders' capacity had to be complemented by rescuers at regional level, an example of the categorization in Table 1). The island is popular with tourists, so multilingual information was needed also to coordinate search and rescue operations. The 2022 Ischia landslide showcased some cascading effects of socio-economic vulnerability (disregard of natural hazards leads to increased exposure to them). From the 1990s onwards, multiple adjacent fields, from disaster risk reduction, to emergency and crisis management, to climate change science have captained a shift away from confusing natural hazards with the consequences of unmitigated and disregarded risks that cause disasters (Blaikie et al. 1994), which are attributable to vulnerabilities that in many cases emerge from systemic injustices and inequalities.

It is therefore unsurprising that language communities who do not speak proficiently the main languages or who are not targeted by multilingual crisis communication campaigns often suffer the worst consequences from hazards. Gaillard (2019, 15) asserts that 'local researchers should move away from Western sources, concepts, and methodologies. We need different epistemologies to reflect diverse local realities.' Local realities can diversify and enhance emergency management strategies for organizations and institutions operating internationally. However, these realities need advocates; following on Gaillard's statement, interpreters and translators may help *give voices to other local realities*. This is why translating hazards matters and cannot happen without focusing on low-resource languages and their speakers.

2 Risk Communication and Hazards

At the outset of the 21st century, Translation and Interpreting Studies (TIS) researchers, scholars, and professionals initiated cross-disciplinary collaborations focused on aspects of language and culture mediation in emergency contexts (Bulut and Kurultay 2001; Kurultay, Bulut, and Kahraman 2002). These draw on previous studies focused on multilingual communication in conflict areas (e.g. Salama-Carr 2007), on the narratives emerging from conflict areas (Baker, 2006), and on communication strategies of humanitarian actors (Moser-Mercer and Bali 2007; Moser-Mercer, Kherbiche, and Class 2014; Tesseur 2019). Studies intensified in the last decade (for an initial bibliography see Alexander and Pescaroli 2020; Kurultay and Bulut 2012; Federici 2016; Federici and Declercq 2020; Cadwell, Bollig, and Ried 2020; O'Brien 2016, 2019; O'Brien and Cadwell 2017; O'Brien and Federici 2020, 2023a; O'Brien et al. 2018). These studies indicate that we have barely started investigating the relationships between risk perception and communication of hazards in linguistically complex societies.

Translation – intended here broadly in all its multimodal facets, from audiovisual translation and sign language, via interpreting and speech recognition, to leaflet translation – is key to participating in debates around hazards and risks. From spontaneous initiatives (which have merits, as shown in Cadwell, 2014, 2015; Cadwell & O'Brien, 2016) to more concerted modes of citizen translation (Federici & Cadwell, 2018), they all contribute to higher levels of understanding, encouraging better preparedness to face and deal with hazards. As already noted earlier, there is a necessity to create ecosystems of preparedness that recognize language as a crucial tool to discuss the interrelations between local and global hazards (Federici, O'Hagan, et al. 2021), whereby scientific experts, professional translators and interpreters, institutions, and civil society organizations all networked together can coordinate large-scale campaigns of information around hazards.

Yet, it is undeniable that multilingual communication around hazards depends on terminology, on knowledge, and on human resources to vehicle knowledge and terminology across linguistic borders. It needs trained interpreters and translators, or at least good resources to help speakers of multiple languages for language combinations for which training does not exist, nor a professional market will ever appear. All of these essential resources are distinct areas of power struggles. Without access to bilingual dictionaries, translators and interpreters have fewer resources to convey technical messages at all, let alone in a clear and accessible manner, in target languages belonging to communities that would continue to remain marginalised. Without deployment of existing technologies that support translation and interpreting work on a global scale, any global warning system is not truly global, but merely a pretence of global, dependent on the dominant English language. Without development of hard and soft translation, interpreting, and intercultural communication skills, hazards continue to be weighted in multiple measures for different people, perpetuating vulnerabilities due to socio-economic patterns (Blaikie et al. 1994; Wisner 1998; Wisner et al. 2003; Birkmann and Wisner 2006; Wisner 2016), in which linguistic diversity is itself a vulnerability. There is a need to focus on translating hazards, because equal access to information on how multi-hazards and single-hazard events create cascading crises is not only a human right but also an instrument to reduce risks by increasing projects and actions that enhance multilingual crisis communication (O'Brien and Federici 2020; Federici and O'Brien 2020; O'Brien and Federici 2023a). Working with professional associations to develop crisis translation training and crisis translation task groups could be an essential way to create the human capital of interpreters, translators, and intercultural mediators (Zhang and Eugeni 2022), who can then support more inclusive participation and sharing of information around hazards. Knowledge does not dissipate disinformation, misinformation, and propagation of conspiracy theories. Certainly, however, lack of access to information in language and formats that people understand undermines any attempts of local, national, international, and supranational organizations to build trust.

The role of T&I in emergency management practices, especially in connection with the need to address the climate change emergency, is strategic, crucial, practical, essential, inevitable, and equitable. Translating hazards is strategic because it supports risk reduction and mitigation. It is crucial because broader pools of experts and researchers, including citizen scientists, provide larger datasets and better local knowledge to deal with hazards (Gaillard 2019; J.R. Cadag 2022). It is practical because it takes time to develop T&I resources (human, lexical, and technological). It is essential because without appropriate multilingual communication local hazards continue to increase vulnerability for multilingual communities already affected by other marginalizing and alienating socio-economic factors. It is inevitable because crisis communication is most effective when everybody at risk receives information and has access to relevant information; at some point, regardless of SOPs and budgets, embedding multilingual communication will need to happen consistently and coherently (Guadagno and Matthews 2023). It is equitable because hazards do not discriminate who is affected, but unmet language needs add vulnerability for those already living in marginalised conditions.

In Section 1, I introduced the core objectives of the Sendai Framework for risk reduction; these objectives presuppose coordinated global actions leveraging community engagement. Moving from informing to engaging communities, the UN Office for Disaster Risk Reduction compiled a technical glossary of terms to create a standard agreement at least among scientists, the UNDRR Terminology. The first Terminology (2009) was shortened in its online 2016 revision, which emphasised its aim of educating communities to understand local hazards, the relationship between multi-hazards and risks, and the relationship between climate change and multi-hazard events. Its aims and purposes are strategically vital and relevant, but the topics it covers are complex and the boiled-down UNDRR Terminology creates endless translation problems for oral and low-resources languages (for an example, see Federici, Mannah, et al. 2021)

To translate hazards means creating an ecosystem of linguistic preparedness. The ecosystem may allow us to design and deliver multilingual crisis communication strategies where multiple actors, guided by policies, legislations, language supports, and technologies enact plans that accommodate the language needs of multilingual communities (Cadwell and O'Brien 2016; Federici, O'Hagan, et al. 2021). The solution is not univocal: we need more technical T&Is. The solution is not simple: we need more technologies that will support human T&Is. The solution is ecosystemic, but it needs political willingness, a suitable legislative framework pursuing social justice and equity, and collaboration among professionals from many different backgrounds.

The aim is to increase superdiverse societies' hazard resilience. Resilience is intended here as a coordinated approach in which institutions, residents, and politicians are collaborating to achieve social

resilience. In other words, it is not a neoliberal blame-game and an attempt to diminish political responsibility around the safety of people living in a geographical area with a complex hazardscape. I intend social resilience as the combination of a multi-agency approach to understand, act, and counteract local hazards. To reduce the risks associated to specific hazards – earthquakes, floods, drought, etc. – there is the need to improve infrastructure and to protest against activities that increase the impact of hazards. For instance, unregulated housing developments in flood-prone planes, unprotected by insurance, are not natural hazards, they are constructed hazards; but the ability of a house-buyer to understand the relevance of the hazards for their family is dependent on accessing information.

In a global perspective, over 40% of the world-population lives in naturally bi- or multilingual contexts; and the majority operates in contexts where languages are acquired as they provide socio-economic and cultural opportunities. In other words, multilingual communication should be the norm around crisis communication and hazards, but the dominance of English among the technical/scientific languages and of a monolingual mindset in dealing with top-down information sharing have diminished the availability of information around hazards in formats and languages to which people can have access. In hazard-driven health emergencies (epidemics, pandemics, post-disaster morbidity), the WHO recognize the need to embed multilingualism in SOPs and advocate for it in its policies for multilingual crisis emergency and risk communication (WHO, 2017). In 2018, the Sphere Project confirmed that it is deontologically mandatory to assess language needs in the international humanitarian sector (see Sphere Project, 2018). These guidelines and policies, alongside the promising recommendations of the 2022 *Global Assessment Report* (UNDRR 2022) suggest that the tipping point in favour of more inclusive linguistic practices in risk communication may be closer.

To implement these policies, however, we need to develop language capacity; there is less room for optimism on finding the resources needed for this. Language capacity includes anything from (paper/digital) dictionaries, corpora, machine translation engines, translation and interpreting training, and developing a multimodal skillset among professional language service providers. To create this capacity, costly and slow changes are needed, which do not happen overnight.

What we defined as ecosystems of linguistic preparedness could represent viable alternatives that embed translation of knowledge around hazards. They are ecosystems because they rely on direct and active participation of all the people involved in creating access to information about local hazards, so that resources for effective communication of local hazards are relevant to local multilingual communities (Federici, Mannah, et al. 2021; Federici, O'Hagan, et al. 2021). Where language service provision may be limited, compared to the scale of local multilingualism, multi-agency activities, which

are low-cost and high impact, can facilitate dynamic interactions between diverse groups over phased, multi-stakeholder activities. These involve T&I professionals, whose training, skills, and language combinations allow them to work in institutional and commercial sectors, facilitating the development of fundamental skills among speakers of languages that are not necessarily used commercially but that are widely used by marginalised communities. By enabling training of members of marginalised communities, T&I professionals can contribute to increasing the social understanding of the role of translation and interpreting, beyond the commercial sector. Doing so while respecting codes of practices, though, is not easy.

There is a shared need and urgency for everybody in specific regions to understand the impact of hazards. Understanding does not mean actively taking preventative measures, but providing access to relevant, meaningful, and multidirectional information ('I decide what I need, it's not imposed on me') is crucial for equality. We can make the wrong choices, but we should all have access to very similar information on which we base our choices.

3 Multilingual Communication and Technologies

Efficient communication concerning (multi-)hazard disasters may reduce risks if it induces changes in behaviour; this behaviour-changing form of risk communication depends on trust and existing relationships. It is dependent on language to encourage critical understanding of local hazards, and their connected risks; it takes time to develop and resembles more gradual education and a long-term information campaign than a crisis communication strategy in a response phase. Both communicative strategies have the same ultimate goal: to reduce or mitigate risks and their impact on at-risk population, properties, and institutions – as disasters also jeopardize the credibility of administrative authorities and governments (Apodaca 2017).

Community engagement is therefore key to more democratic forms of multilingual communication to prevent, prepare for, and deal with risks caused by local hazards to local residents. In emergency management, communication practices kick in during the response phase. Lundgren and McMakin (2018, 499) define such risk communication practices as

> the interactive process of exchange of information and opinions among individuals, groups, and institutions concerning a risk or potential risk to human health or the environment. Any risk communication effort must have an interactive component, if only in soliciting information about the audience in the beginning or evaluating success in the end.

Such interactions cannot happen as efficiently as necessary if the communicative tools are not there. Take the example of an hospital's emergency department: personnel train to deal with life and death situations, and they train to communicate in a highly specific, rapid, and whenever possible effective manner. Their 'exchange of information' is interactive, but it has honed over time. This example is ad absurdum, considering the most complex form of risk communication, but I use it to argue that even in such specialised environments, communicative interaction rests on practice. It is therefore highly unlikely that soliciting information at the beginning or evaluating success at the end of a risk communication campaign in multilingual contexts can happen at all without any resources to support intercultural communication in its many modalities (oral, written, multimodal, audiovisual, signed).

On the one hand, the information challenges posed by both the hands-on and the research-driven definitions of risk communication concerning hazards necessitate a commitment to multilingual risk communication practices on a scale never attempted before. On the other hand, there continues to be an underlying approach to presuming that the language resources (people, vocabularies, supporting technologies) are available to proceed with successful risk communication campaigns originating in one language and serving multilingual communities.

The IFRC World Disasters Reports regularly highlight the consequences of the status quo. In 2018, the report stressed that 'Speakers of minority languages who are not fluent in the official national language(s) are at a structural disadvantage in many countries' (IFRC 2018, 103). This is an example of the socio-economic vulnerabilities of groups whose language needs remain unmet and, in turn, their cultures subaltern, as 'humanitarian responses are usually coordinated in international lingua francas and delivered in a narrow range of national languages' (2018, p. 103). Despite the flurry of multilingual communication practices over two years of the COVID-19 pandemic, the 2021 report of the IFRC reiterated the need to 'Recognize and use local knowledge and experience', adding that 'with many hazards, people with limited literacy and non-native language speakers also face heightened risk as they may not be able to understand advisories or read health advice' (IFRC 2021, 57).

Lundgren and McMakin's argue that (2018, p. 433) 'planning for communication before, and during an emergency is especially important, for vulnerable or at risk populations'. This position is widely shared among crisis communication experts, there is a gaping lacuna in the sector of risk communication around hazards: limited use of language automation technologies on early warning systems. Planning for communication should read as planning for multilingual communication in relation to multi-hazards contexts that tend to have cross-border consequences. Multilingual needs are to be expected and technologies can aid the role of translation as risk reduction. In fact, the use and role of translation technologies in disasters is documented in some recent systematic reviews of the

literature (O'Brien 2019; Escartín and Moniz 2020; Rico Pérez 2020; Cadwell, O'Brien, and DeLuca 2019; Rogl 2017; Ogie, O'Brien, and Federici 2021); here I want to focus specifically on translation technologies as part of early warning systems (EWS). In the next section, I illustrate how these are likely to provide support, not replacement, for T&I professionals operating in long-term multilingual risk communication campaigns, as well as in the response phase primarily targeted by the early warning systems.

3.I EWS Technologies

Early warnings are crucial to respond to disasters triggered by natural hazards. EWS combine communication immediacy across the globe with sophisticated predictive algorithms that, using mathematical models, forecast severe weather events, volcanic eruptions, and tremor waves (see a critical review and discussion of EWS in Alcántara-Ayala and Oliver-Smith 2019). As disaster risk reduction and emergency management need to respond to the social roots causes of the impact of multi-hazard disasters, there is recent call for a revision of the EWS to reflect societal and cultural needs. Alcántara-Ayala and Oliver-Smith (2019, 324) argue that 'the definition, architecture, and function of EWSs should be rewritten by stimulating their transformation into early warning articulated systems (EWASs)'. Initially designed to provide advance notice of a hazard creating imminent risks for a population, EWSs are incredibly complex monitoring technologies focused on a notion of *disseminating information*. EWS supposedly enable prompt dissemination of warnings to all residents of a geographical area who may be exposed to the risks caused by local hazards. However, such sophisticated systems rarely consider the multiplicity of languages locally spoken. As a result, EWS risk being only high-level warning systems for emergency services and emergency managers, who will then have to create impromptu risk communication strategies. In short, they represent a missed opportunity to integrate translation memories resources in their systems to support multilingual outputs through complete (machine translation engines) or partial automations (post-edited outputs).

From the previous sections, I draw the argument that as multilingual communication already lacks many essential resources in languages that do not have large corpora, are not used digitally, and are used by marginalised ethnic or local groups, the impact of EWS is affected by the compound vulnerability of their linguistic diversity. I agree that 'early warning articulated systems (EWASs)' are to be 'composed of a coordinated structure with the capacity to contribute to the implementation of strategies of action to achieve DRR and DRM based on the understanding of disaster risk and disasters as a process constructed by societies' (Alcántara-Ayala and Oliver-Smith 2019, 324). For organizations that rely on them to coordinate international response and humanitarian operations, such as the

International Federation of Red Cross and Red Crescent Societies, the EWS cannot function without a focus on language, as their *World Disasters Report 2020. Come heath or high water* emphasises:

> Early warning information must be provided in the right language – in terms of local and minority languages – and using terminology that makes sense to the community. It is essential to have a process to engage communities and understand needs, priorities and what works for them. (IFRC 2021, 203)

EWSs enable timely responses to crises determined by natural hazards (excluding technological and conflict-related hazards). Drawing upon large datasets, they would be perfect platforms to integrate language automation in multiple forms. They integrate data from scientific collaboration and data crawling, they use machine learning to filter both peer-reviewed data sources and other internet sources. They tend to be used to cascade crucial information early on to alert emergency services and authorities. From these considerations alone, it is obvious to imagine EWSs as systems that can be supported by human translations integrated in translation memories or even machine translation engines.

By design, EWSs support efficient distribution of crucial information, urgently needed to initiate the response; they support emergency services and authorities to initiate response protocols once a hazard is about, or triggers a cascading crisis. It could be argued that collating standard messages used within these systems in simplified format could be useful to create gradually a multilingual databank of quality translations. Produced by translators, with the time necessary to create purposeful rendering of technical information – a time that is often long for low-resource languages (see experiment in Tekwa and Tazoacha 2022) – the rendering could be part of translation memories ready to be deployed through the automated channels used by the early warning systems. The databanks would support EWSs to become more culture-appropriate EWAS and, in turn, the translation memories would serve as additional resources that may relieve pressure on limited human resources – translators and interpreters locally available and able to liaise with local and international rescue teams are often themselves affected by the crisis and exposed to the risks created by the hazards (as discussed by Mahadin and Olimat in this special issue).

Inclusion of translation and language automation processes in EWS equates to a better use of technology to free up the (always finite) multilingual resources. These could then enable more democratic and multidirectional communication supporting the needs for information of the affected communities. Human translation focused on the demand of affected people could complement the *dissemination of information*, with a more suitable and far-reaching *offer* of information. This is

particularly important also considering how even the most perfect system designed to deliver messages instantaneously still faces issues of digital divide and of broadband poverty (lack of resources to purchase mobile phone/internet data, in combination with exposure to infrastructural damage caused by the hazard that could limit communication). More EWSs should integrate translation automation in support of human-translation (see Federici et al. 2023; Kreutzer et al. 2020), so as to enable translators and interpreters in affected communities to support *communication* rather than *dissemination of information.*

EWSs do not already use forms of language automation to provide multilingual warnings as outputs using geographic information systems to determine locally needed languages, even though EWS are based on integrated architectures that use machine translation engines as inputs for monitoring hazards (for instance, EIOS and GDACS). In part, the question is rhetorical, as distribution of languages in specific geographic areas is still difficult to map, and displacement makes it challenging to predict all local language needs when large groups of people are on the move.

Prevention and preparedness are arguably of equal importance to carry out research activities, advocacy, and activism among T&I communities. For multilingual countries with limited capacity to respond to local hazards, and with exposure to hazards, preparing local communities with collaborative campaigns aiming to educate people at risk about the hazards they face can generate knowledge as well as practical resources (bilingual corpora, aligned translation memories, even low-resource translation memory engines). Resourcing of this kind can hamper attempts at educating multilingual communities using regional or international lingua francas. For multilingual communities with limited written resources, limited digital presence and content (which are sources for training machine translation engines), it is challenging to resource even widely spoken local language that could support T&I. Using technology-driven innovations focused on EWSs has two-fold benefits. Not only is it useful in the perspective of developing machine translation engines, but its technological solutions enable the development of crucial resources for low-resources languages (as experienced in the project detailed in Federici, Mannah, et al. 2021). In this perspective, the Global Disaster Alert and Coordination System (GDACS) and the Epidemic Intelligence from Open Sources (EIOS) could significantly improve the adaptive capacity of multilingual, low-income regions, by providing essential bilingual corpora to enable the use of computer-aided translation tools, the development of gisting resources based on statistical and neural machine translation engines, and the development of computer-aided interpreting tools (Fantinuoli and Prandi 2021; Fantinuoli 2017).

GDACS focuses on natural geomorphological hazards; the system is freely accessible online, supported by live digital maps (see Figure 1). It provides updates in real-time relating to natural

hazards that may be creating risk in specific geographical areas. It distributes its warnings to local emergency managers and monitoring bodies. EIOS monitors any internet-based activity (newspapers, blogs, social media posts, etc.) to extract data about disease outbreaks – it picked up the epidemic in Wuhan on 29 December 2019, and alerted WHO officials. Could these systems use machine translation engines for their most codified warning messages? They may not create immediately 10,000 segments, but they can be a start for language combinations outside the 300+ served by global providers and the 100-200 languages for which machine translation engines exist.

<INSERT FIGURE 1 HERE>

Figure 1. A live map generated on 12 April 2023 by the GDACS.

Figure 1 gives a sense of the monitoring scale of systems like GDACS. Whereas EIOS follows in the footsteps of the Canadian Global Public Health Intelligence Network (Carter, Stojanovic, and de Bruijn 2018) with its use of machine translation and human translators to monitor multilingual sources of information for outbreaks, its global scale offers an opportunity to develop bilingual resources. Such resources can then be deployed and used in other sectors; for instance, to create and deliver multilingual training sessions on health emergencies, as those provided by the OpenWHO platform. Current translation technologies are envisaged here as resources supporting translators, interpreters, and intercultural mediators in many ordinary multilingual interactions; they cannot be identified as off-the-shelf one-stop solutions for efficient multilingual crisis communication. Their usage can develop tools for T&I professionals for speakers of two non-commercial languages who have to translate and interpret for their communities to develop higher levels of preparedness in lesser used languages, or languages that exists in predominantly oral varieties.

4 Concluding remarks

The 21st century imposes that we look at multi-hazard contexts as a global challenge. The COVID-19 pandemic showed how far reaching the cascading effects of crises are, moving from health emergency to economic crises at local and continental levels, to renewed instability in global political relationships. Natural hazards, such as those from disease mutations, are likely to increase at the current rate of climate change. The Sendai 2015-2030 Framework for Disaster Risk Reduction (UNDRR 2015) underpins the (best) intentions of the international agenda to respond to these challenges. Its definitions, its aims, and its global objectives rest on intercultural communication that should use multimodal translation, interpreting, and signing to focus on concerted actions to be carried out a global scale to contrast the impact of multi-hazard events. In this article, I condensed together

arguments that advocate for a more intense scrutiny of intercultural communication practices in relation to hazards. The perspective is shifting, and should do so more rapidly, towards developing multilingual resources that enhance local preparedness and equal access to resources thus increasing every long-term or recent resident resilience. A strategic increase of attention to the role of multilingual communication facilitates the response phases when a hazard triggers a new disaster. Effective crisis communication strategies can be adopted to communicate risks multilingually. There is an urgent need to hear voices from all around the world contributing to local risk reduction practices and influencing global practices, as appropriate; and there is a need for evidenced knowledge to be disseminated more widely than in the main lingua francas of scientific publications.

Technical discourses, scientific narratives, operational jargons, and translations of locally collected data to publish papers in English could be a resource or an obstacle. Translation, interpretation, and intercultural mediation have roles to play in creating more efficient forms of multilingual crisis communication. Ensuring nuanced conversations about local hazards through multiple channels and media, accessible to more people regardless of their economic means, translations can play a risk reduction role, as well as a role in developing resilience appropriate to the local needs. Language automation too has a role to play by supporting multilingual risk communication practices and developing the resources needed to educate people on hazards, risks mitigation, post-disaster recovery, and sustainable development after hazards trigger disasters. In translating hazards, the enhancement of human-computer interactions to provide additional resources in those contexts in which few or none exists is a priority, not to substitute humans but to create effective T&I practices. The availability of powerful language technologies predominantly in high-resource languages continues to perpetuate the linguistic inequality that skews any attempts to enhance preparedness in multilingual communities, develop resources in response to disasters, and improve our global understanding of hazards through better access to local knowledge and practices.

Research on disaster education and cultural inclusion is still an emerging field. There are, to date, only a few large-scale collaborative projects that involve universities and public and private disaster organisations working on issues around multilingual education concerning hazards and inclusion for marginalised or extremely multilingual communities. Studies are needed to explore translation of scientific knowledge concerning appropriate culture- and language-specific communication, as literal and figurative translations of knowledge are resources directly applicable in supporting at-risk communities through projects that better deploy existing language technologies, and in activities that continue to advocate for equal access to information for multilingual communities. A disaster can engender impacts that create long-term crises, or a local natural hazard can trigger a disaster

exacerbated by existing crises in a society (e.g., flooding causing internal migration, forcing millions of people to move into poorer communities that were already living on limited resources). Until the centrality of language in crisis and emergency risk communication is fully acknowledged, it is imperative to talk about cascading crises to advocate for equal opportunities for multilingual communication. Equity must be achieved regardless of channels, modes, and tools for multilingual communication.

Enabling better multilingual communication on hazards is an objective that Translation and Interpreting Studies researchers are pursuing in cross-disciplinary research activities (see approaches collected in O'Brien and Federici 2023b) and advocating for more attention to crisis communication in collaboration with professional associations too. This Special Issue illustrates key areas for action and research, subdivided in three sections each grouping three articles. The first three articles focus on roles, functions, and terminology of actors and agents; Vidal Claramonte deals with power relations and hegemonic languages; Todorova analyses the urgency of including indigenous voices, and Cabezas-García and León-Araúz remind the readers how translating hazards present terminological challenges even for high-resource languages. The second section considers the effects of translating hazards on operators, recipients, and professionals; Yañez studies the impact of interpreting-specific risks in international organization; Li, Wang, and Zhou Rasmussen assess the results of an experiment assessing the psychophysiological effects of crisis communication stressors on interpreters; and Al-Balqa and Olimat report on their qualitative study of the nexus between financial security and mental wellbeing of TIS professionals in Jordan during the COVID-19 pandemic. The third section pertains to communicating health risks; Al-Shehari assesses the relationships between multilingual crisis communication policies and practices in Qatar during the COVID-19 pandemic; Lázaro Gutiérrez and Cabrera Méndez consider how multilingual communication approaches used in telehealth settings had an impact on interpreting in Spain, at the start of the pandemic; and Valdez discusses the expectations of healthcare professional regarding the translation of health warnings and hazardous biomedical contexts.

This Special Issue, taken in its entirety, carries one overarching message: delaying any understanding of the increasing magnitude of natural hazards is no longer an option. For everybody to have an equal chance to adopt informed behaviours around risks, access to information about local hazards must be in formats and languages that all local residents can access and understand.

References

Alcántara-Ayala, Irasema, and Anthony Oliver-Smith. 2019. "Early warning systems: lost in translation or late by definition? A FORIN approach." *International Journal of Disaster Risk Science* 10 (3): 317-331.

Alexander, David E. 2013. "Vulnerability." In *Encyclopedia of Crisis Management*, edited by K Bradley Penuel, Matt Statler and Ryan Hagen, 980-983. Thousand Oaks, CA: Sage Publications.

Alexander, David E, and Gianluca Pescaroli. 2020. "The role of translators and interpreters in cascading crises and disasters." *Disaster Prevention and Management: An International Journal* 29 (2): 144-156. https://doi.org/10.1108/DPM-12-2018-038.

Almiron, Núria. 2019. "Rethinking the ethical challenge in climate change lobbying: A discussion of ideological denial 1." In *Climate Change Denial and Public Relations*, edited by Núria Almiron and Jordi Xifra, 9-25. London; New York, NY: Routledge.

Apodaca, Clair. 2017. *State Repression in Post-Disaster Societies*. London; New York, NY: Routledge.

Appleby-Arnold, Sandra, Noellie Brockdorff, Ivana Jakovljev, and Sunčica Zdravković. 2018. "Applying cultural values to encourage disaster preparedness: Lessons from a low-hazard country." *International Journal of Disaster Risk Reduction* 31: 37-44. https://doi.org/https://doi.org/10.1016/j.ijdrr.2018.04.015. http://www.sciencedirect.com/science/article/pii/S2212420918300554.

Bankoff, Gregory. 2019. "Remaking the world in our own image: vulnerability, resilience and adaptation as historical discourses." *Disasters* 43 (2): 221-239. https://doi.org/https://doi.org/10.1111/disa.12312. https://onlinelibrary.wiley.com/doi/abs/10.1111/disa.12312.

Birkmann, Jörn, Omar D Cardona, Martha L Carreño, Alex H Barbat, Mark Pelling, Stefan Schneiderbauer, Stefan Kienberger, Margreth Keiler, David E Alexander, Peter Zeil, and Torsten Welle. 2013. "Framing vulnerability, risk and societal responses: the MOVE framework." *Natural Hazards* 67 (2): 193-211. https://doi.org/10.1007/s11069-013-0558-5. https://doi.org/10.1007/s11069-013-0558-5.

Birkmann, Jörn, Dunja Krause, Neysa Jacqueline Setiadi, Dora-Catalina Suarez, Torsten Welle, Jan Wolfertz, Ralph Dickerhof, Peter Mucke, and Katrin Radtke. 2011. *World Risk Report 2011, Alliance Development Works*. Berlin: Bündnis Entwicklung Hilft.

Birkmann, Jörn, and Benjamin Wisner. 2006. *Measuring the unmeasurable: the challenge of vulnerability*. UNU-EHS.

Blaikie, Piers, Terry Cannon, Ian Davis, and Ben Wisner. 1994. *At Risk. Natural Hazards, People's Vulnerability and Disasters*. London; New York: Routledge.

Bosher, Lee, Ksenia Chmutina, and Dewald van Niekerk. 2021. "Stop going around in circles: towards a reconceptualisation of disaster risk management phases." *Disaster Prevention and Management: An International Journal* 30 (4/5): 525-537. https://doi.org/10.1108/DPM-03-2021-0071. https://doi.org/10.1108/DPM-03-2021-0071.

Bulut, Alev, and Turgay Kurultay. 2001. "Interpreters-in-aid at disasters: community interpreting in the process of disaster management." *The Translator* 7 (2): 249-263.

Cadag, Jake Rom. 2022. "Decolonising disasters." *Disasters* 46 (4): 1121-1126. https://doi.org/https://doi.org/10.1111/disa.12550. https://onlinelibrary.wiley.com/doi/abs/10.1111/disa.12550.

Cadag, Jake Rom D. 2019. "Participatory research methods for language needs in disaster research " In *Translation in Cascading Crises*, edited by Federico M Federici and Sharon O'Brien, forthcoming London; New York, NY: Routledge.

Cadwell, Patrick. 2014. "Translation and Interpreting Needs in the Great East Japan Earthquake of 2011." In *Man versus Machine: Proceedings of the XXth FIT World Congress (Vol. II)*, edited by W. Baur, B. Eichner, S. Kalina, N. Kessler, F. Mayer and J. Orsted, 752-760. Berlin: BDÜ.

Cadwell, Patrick, Claudia Bollig, and Juliane Ried. 2020. "Management and Training of Linguistic Volunteers." In *Translation in Cascading Crises*, edited by Federico M Federici and Sharon O'Brien, 152-173. Abingdon; New York, NY: Routledge.

Cadwell, Patrick, and Sharon O'Brien. 2016. "Language, Culture, and Translation in Disaster ICT: An Ecosystemic Model of Understanding." *Perspectives. Studies in Translation Theory and Practice* 24 (4): 557-575. https://doi.org/10.1080/0907676X.2016.1142588.

Cadwell, Patrick, Sharon O'Brien, and Eric DeLuca. 2019. "More than tweets: A critical reflection on developing and testing crisis machine translation technology." *Translation Spaces* 8 (2): 300-333.

Cannon, Terry. 2008. "Vulnerability, "innocent" disasters and the imperative of cultural understanding." *Disaster Prevention and Management: An International Journal* 17 (3): 350-357. https://doi.org/10.1108/09653560810887275.

Carter, Dave, Marta Stojanovic, and Berry de Bruijn. 2018. "Revitalizing the Global Public Health Intelligence Network (GPHIN)." *Journal of Public Health Informatics* 10, no. 1 (e59). https://doi.org/10.5210/ojphi.v10i1.8912.

Chmutina, Ksenia, Neil Sadler, Jason von Meding, and Amer Hamad Issa Abukhalaf. 2021. "Lost (and found?) in translation: key terminology in disaster studies." *Disaster Prevention and Management: An International Journal* 30 (2): 149-162.

Chmutina, Ksenia, and Jason Von Meding. 2019. "A Dilemma of language:"Natural disasters" in academic literature." *International Journal of Disaster Risk Science* 10 (3): 283-292.

Chmutina, Ksenia, Jason Von Meding, and Lee Bosher. 2019. "Language Matters: Dangers of the "Natural Disaster" Misnomer." *Contributing paper to Global Assessment Report (GAR)*.

Clarke, Ben, Friederike Otto, Rupert Stuart-Smith, and Luke Harrington. 2022. "Extreme weather impacts of climate change: an attribution perspective." *Environmental Research: Climate* 1 (1): 012001.

Cornia, Alessio, Kerstin Dressel, and Patricia Pfeil. 2014. "Risk cultures and dominant approaches towards disasters in seven European countries." *Journal of Risk Research* 2: 1-17. http://www.scopus.com/inward/record.url?eid=2-s2.0-84907892077&partnerID=40&md5=0622bf2cd0e8cd1da055671845b2fd4e.

Cronin, Michael. 2003. *Translation and Globalization*. London; New York, NY: Routledge.

---. 2013. *Translation in the digital age*. London; New York, NY: Routledge.

---. 2017. *Eco-translation: Translation and Ecology in the Age of the Anthropocene*. London; New York, NY: Routledge.

DasGupta, Rajarshi, and Rajib Shaw. 2017. "Disaster risk reduction: A critical approach." In *The Routledge handbook of disaster risk reduction including climate change adaptation*, edited by Ilan Kelman, Jessica Mercer and Jean-Christophe Gaillard, 12-23. London; New York, NY: Routledge.

Davis, Lawrence 2015. "Minorities' perception of the comprehensive emergency management model of distributing information." PhD, College of Social and Behavioral Sciencews, Walden University. https://search.proquest.com/docview/1680832764?accountid=14511.

Declercq, Christophe, and Federico M Federici. 2020. "Words of Empathy, Access and Relief." In *Intercultural Crisis Communication. Translation, Interpreting and Languages in Local Crises*, edited by Federico M Federici and Christophe Declercq, 1-18. London; New York, NY: Bloomsbury Academic.

Douglas, Mary, and Aaron Wildavsky. 1983. *Risk and culture: An essay on the selection of technological and environmental dangers*. Berkeley, CA; London: University of California Press.

Dunlap, Riley E, and Robert J Brulle. 2020. "Sources and amplifiers of climate change denial." In *Research Handbook on Communicating Climate Change*, edited by David C Holmes and Lucy M Richardson, 49-61. Cheltenam; Northampton, MA: Edward Elgar.

Easthope, Lucy. 2022. *When the Dust Settles: The Instant Sunday Times Bestseller*. London: Hodder & Stoughton.

Escartín, Carla Parra, and Helena Moniz. 2020. "Ethical considerations on the use of machine translation and crowdsourcing in cascading crises." In *Translation in Cascading Crises*, edited by Federico M Federici and Sharon O'Brien, 132-151. London; New York, NY: Routledge.

Fantinuoli, Claudio. 2017. "Computer-assisted interpreting: challenges and future perspectives." In *Trends in E-tools and resources for translators and interpreters*, edited by Isabel Durán and Gloria Corpas, 153-174. Amsterdam: Brill Rodopi.

Fantinuoli, Claudio, and Bianca Prandi. 2021. "Towards the evaluation of automatic simultaneous speech translation from a communicative perspective." Proceedings of the 18th International Conference on Spoken Language Translation (IWSLT 2021), Bangkok, Thailand (online).

Federici, Federico M. 2016. "Introduction: A state of emergency for crisis communication." In *Mediating Emergencies and Conflicts. Frontline Translating and Interpreting*, edited by Federico M. Federici, 1-29. New York, NY: Palgrave Macmillan.

Federici, Federico M, and Patrick Cadwell. 2018. "Training Citizen Translators: Red Cross translation needs and the delivery of a bespoke training on the fundamentals of translation." *Translation in non-governmental organisations. Special issue of Translation Spaces. Edited by Wine Tesseur.* 7 (1): 20-43. https://doi.org/https://doi.org/10.1075/ts.00002.fed.

Federici, Federico M, and Christophe Declercq, eds. 2020. *Intercultural Crisis Communication. Translation, Interpreting and Languages in Local Crises*. London; New York, NY: Bloomsbury Academic.

Federici, Federico M, Christophe Declercq, Jorge Díaz Cintas, and Rocío Baños Piñero. 2023. "Ethics, Automated Processes, Machine Translation, and Crises " In *Towards Responsible Machine Translation. Ethical and Legal Considerations in Machine Translation*, edited by Helena Moniz and Carla Parra Escartín, 135-156. Cham: Springer.

Federici, Federico M, Pious Mannah, Jonas Knauerhase, Shaun Pickering, and Chloe Franklin. 2021. *Community Preparedness and Linguistic Equality in Sierra Leone. Project Report.* London: CenTraS.

Federici, Federico M, and Sharon O'Brien. 2020. "Cascading Crises: Translation as Risk Reduction." In *Translation in Cascading Crises*, edited by Federico M Federici and Sharon O'Brien, 1-22. London; New York, NY: Routledge.

Federici, Federico M, Minako O'Hagan, Patrick Cadwell, Jay Marlowe, and Sharon O'Brien. 2021. "Ecosystems of Preparedness in New Zealand: Empowering Communities and Professionals with Crisis Translation Training." In *Translating and Interpreting in Australia and New Zealand. Distance and Diversity* edited by Judy Wakabayashi and Minako O'Hagan, 125-145. London: Routledge.

Ferris, Elizabeth. 2017. "Humanitarian Protection Perspectives for Disaster Risk Reduction Including Climate Change Adaptation." In *The Routledge Handbook of Disaster Risk Reduction Including Climate Change Adaptation*, edited by Ilan Kelman, Jessica Mercer and J. C Gaillard, 161-172. London; New York, NY: Routledge.

Field, Jessica. 2017. "What is appropriate and relevant assistance after a disaster? Accounting for culture(s) in the response to Typhoon Haiyan/Yolanda." *International Journal of Disaster Risk Reduction* 22: 335-344. https://doi.org/10.1016/j.ijdrr.2017.02.010.

Gaillard, Jean-Christophe. 2010. "Vulnerability, capacity and resilience: perspectives for climate and development policy." *Journal of International Development* 22 (2): 218-232.

---. 2019. "Disaster studies inside out." *Disasters* 43 (1): S7-S17. https://doi.org/10.1111/disa.12323.

Gierlach, Elaine, Bradley E Belsher, and Larry E Beutler. 2010. "Cross-cultural differences in risk perceptions of disasters." *Risk Analysis: An International Journal* 30 (10): 1539-1549.

Gizzi, Fabrizio Terenzio, Donatella Porrini, and Francesco De Masi. 2021. "Building a Natural Hazard Insurance System (NHIS): The Long-lasting Italian Case." *Sustainability* 13 (21): 12269.

Guadagno, Lorenzo, and Reshma Matthews. 2023. "Addressing Language Barriers to Provide Inclusive Assistance to Migrants and Refugees." In *Translating Crises*, edited by Sharon O'Brien and Federico M Federici, 411-427. London; New York, NY: Bloomsbury Academic.

Haddow, Barry, Rachel Bawden, Antonio Valerio Miceli Barone, Jindřich Helcl, and Alexandra Birch. 2022. "Survey of low-resource machine translation." *Computational Linguistics* 48 (3): 673-732.

Hawkins, Alesia O, Ananda B Amstadter, Carla Kmett Danielson, Kenneth J Ruggiero, and Heidi M Zinzow. 2009. "Factors associated with exposure and response to disasters among marginalized populations." In *Mental health and disasters*, edited by Yuval Neria, Sandro Galea and Fran H Norris, 277-290. Cambridge; New York, NY: Cambridge University Press.

Hines, Anika L, Roxanne M Andrews, Ernest Moy, Marguerite L Barrett, and Rosanna M Coffey. 2014. "Disparities in rates of inpatient mortality and adverse events: race/ethnicity and language as independent contributors." *International journal of environmental research and public health* 11 (12): 13017-13034.

IFRC. 2018. *World Disasters Report 2018. Leaving no one behind.* International Federation of Red Cross and Red Crescent Societies (Geneva). https://media.ifrc.org/ifrc/wp-content/uploads/sites/5/2018/10/B-WDR-2018-EN-LR.pdf.

---. 2021. *World Disasters Report 2020. Come heat or high water.* International Federation of Red Cross and Red Crescent Societies (Geneva). https://www.ifrc.org/sites/default/files/2021-05/20201116_WorldDisasters_Full.pdf.

Kelman, Ilan. 2020. *Disaster by choice: How our actions turn natural hazards into catastrophes*. Oxford University Press.

Kirmayer, Laurence J, Rachid Bennegadi, and Marianne C Kastrup. 2016. "Cultural awareness and responsiveness in person-centered psychiatry." In *Person centered psychiatry*, edited by Juan E Mezzich, Michel Botbol, George N Christodoulou, C. Robert Cloninger and Ihsan M Salloum, 77-95. Cham: Springer.

Kreutzer, Tino, Patrick Vinck, Phuong N Pham, Aijun An, Lora Appel, Eric DeLuca, Grace Tang, Muath Alzghool, Kusum Hachhethu, Bobi Morris, Sandi L Walton-Ellery, John Crowley, and James Orbinski. 2020. "Improving humanitarian needs assessments through natural language processing." *IBM journal of research and development* 64 (1/2): 9:1-9:14. https://doi.org/10.1147/JRD.2019.2947014.

Kurultay, Turgay, and Alev Bulut. 2012. "Re-Evaluating Community Interpreting: Emergency and Disaster Interpreting." *I.U.Journal of Translation Studies* 3 (6): 75-102.

Kurultay, Turgay, Alev Bulut, and Rana Kahraman. 2002. "New perspectives in community interpreting: Relief interpreting." Proceedings of the II. Colloque International Sur La Traduction: Relations d'interdisciplinarite en Traduction, Yıldız Technical University, 23–25 Oct 2002.

Lundgren, Regina E, and Andrea H McMakin. 2018. *Risk communication: A handbook for communicating environmental, safety, and health risks*. 6th ed. Hoboken, NJ: John Wiley & Sons.

Moser-Mercer, Barbara, and Grégoire Bali. 2007. "Interpreting in Zones of Crisis and War: Improving Multilingual Communication through Collaborative Virtual Learning." MIT/LINC

Conference Technology-enabled Education: A Catalyst for Positive Change, Amman, Jordan, 28-30 October.

Moser-Mercer, Barbara, Leïla Kherbiche, and Barbara Class. 2014. "Interpreting Conflict: Training Challenges in Humanitarian Field Interpreting." *Journal of Human Rights Practice* 6 (1): 140-158. https://doi.org/10.1093/jhuman/hut025. http://dx.doi.org/10.1093/jhuman/hut025.

O'Brien, Sharon. 2016. "Training Translators for Crisis Communication: Translators Without Borders as an Example." In *Mediating Emergencies and Conflicts. Frontline Translating and Interpreting*, edited by Federico M. Federici, 85-111. Houndshill, Basingstoke; New York, NY: Palgrave Macmillan.

---. 2019. "Translation Technology and Disaster Management." In *The Routledge Handbook of Translation Technologies*, edited by Minako O'Hagan, 304-318. London; New York, NY: Routledge.

O'Brien, Sharon, and Patrick Cadwell. 2017. "Translation Facilitates Comprehension of Health-Related Crisis Information: Kenya as an example." *Journal of Specialised Translation* 28: 23-51.

O'Brien, Sharon, and Federico M Federici. 2020. "Crisis Translation: Considering Language Needs in Multilingual Disaster Settings." *Disaster Prevention and Management: An International Journal* 29, no. 2: 129-143. https://doi.org/10.1108/DPM-11-2018-0373.

---. 2023a. "Crisis Translation beyond Words into Action." In *Translating Crises*, edited by Sharon O'Brien and Federico M Federici, 1-14. London; New York, NY: Bloomsbury Academic.

---, eds. 2023b. *Translating Crises*. Edited by Sharon O'Brien and Federico M Federici. London; New York, NY: Bloomsbury Academic.

O'Brien, Sharon, Federico M Federici, Patrick Cadwell, Jay Marlowe, and Brian Gerber. 2018. "Language Translation During Disaster: A Comparative Analysis of Five National Approaches." *International Journal of Disaster Risk Reduction* (31): 627-636. https://doi.org/https://doi.org/10.1016/j.ijdrr.2018.07.006.

Ogie, Robert I., Sharon O'Brien, and Federico M. Federici. 2021. "Towards using agent-based modelling for collaborative translation of crisis information: A systematic literature review to identify the underlying attributes, behaviours, interactions, and environment of agents." *International Journal of Disaster Risk Reduction*: 102717. https://doi.org/https://doi.org/10.1016/j.ijdrr.2021.102717. https://www.sciencedirect.com/science/article/pii/S2212420921006786.

Otaki, Tetsuaki , and Yuki Chai. 2018. "In times of crisis, language barrier leaves some in harm's way." *The Asahi Shimbun*, 31 July 2018, 2018. http://www.asahi.com/ajw/articles/AJ201807310053.html.

Paton, Douglas. 2016. Readiness for Natural Hazards. In *Oxford Research Encyclopedia of Natural Hazard Science*. Oxford; New York, NY: Oxford University Press.

Pescaroli, Gianluca, and David E Alexander. 2015. "A definition of cascading disasters and cascading effects: Going beyond the 'toppling dominos' metaphor." *planet @ risk* 3 (1): 58-67. https://doi.org/https://planet-risk.org/index.php/pr/article/view/208. https://planet-risk.org/index.php/pr/article/view/208/355.

---. 2016. "Critical infrastructure, panarchies and the vulnerability paths of cascading disasters." *Natural Hazards* 82 (1): 175-192. https://doi.org/10.1007/s11069-016-2186-3.

Ponari, Marta, Sara Rodríguez-Cuadrado, David Vinson, Neil Fox, Albert Costa, and Gabriella Vigliocco. 2015. "Processing Advantage for Emotional Words in Bilingual Speakers." *Emotion* 15 (5): 644.

Rico Pérez, Celia. 2020. "Mapping Translation Technology and the Multilingual Needs of NGOs along the Aid Chain." In *Translation in Cascading Crises*, edited by Federico M Federici and Sharon O'Brien, 112-131. London: Routledge.

Rogers, Brooke M., and Julia M. Pearce. 2013. "Risk Communication, Risk Perception and Behavior as Foundations of Effective National Security Practices." In *Strategic Intelligence Management: national security imperatives and information and communications technologies*, edited by Babak Akhgar and Simeon Yates, 66-74. Oxford; Waltham, MA: Butterworth-Heinemann.

Rogl, Regina. 2017. "Language-related disaster relief in Haiti: Volunteer translator networks and language technologies in disaster aid." In *Non-professional Interpreting and Translation. State of the art and future of an emergenging field of research*, edited by Rachele Antonini, Letizia Cirillo, Linda Rossato and Ira Torresi, 231–255. Amsterdam; Philadelphia, PA: John Benjamins.

Ropeik, David. 2002. "Understanding factors of risk perception." *Nieman Reports* 56 (4): 52.

Salama-Carr, Myriam, ed. 2007. *Translating and interpreting conflict*. Vol. 28. Amsterdam; New York, NY: Rodopi.

Scheer, Dirk, Christina Benighaus, Ludger Benighaus, Ortwin Renn, Stefan Gold, Bettina Röder, and Gaby-Fleur Böl. 2014. "The distinction between risk and hazard: understanding and use in stakeholder communication." *Risk Analysis* 34 (7): 1270-1285. https://doi.org/10.1111/risa.12169.

Slovic, Paul, and Ellen Peters. 2006. "Risk Perception and Affect." *Current Directions in Psychological Science* 15 (6): 322-325. https://doi.org/10.1111/j.1467-8721.2006.00461.x. https://journals.sagepub.com/doi/abs/10.1111/j.1467-8721.2006.00461.x.

Sphere, Project. 2018. *The Sphere Project: Humanitarian Charter and Minimum Standards in Humanitarian Response. 4th edition*. 3rd ed. Geneva: Mc Connan.

Tekwa, Kizito, and Francis Tazoacha. 2022. "No worry, dat sick go finish small time: Encouraging local community participation in global healthcare via minority language de-terminologization and ruralization." *Linguistica Antverpiensia, New Series–Themes in Translation Studies* 21. https://lans-tts.uantwerpen.be/index.php/LANS-TTS/article/view/749.

Tesseur, Wine. 2019. "Local capacity building after crisis: The role of languages and translation in the work of development NGOs in Kyrgyzstan." *Disaster Prevention and Management: An International Journal* 29 (2): 214-226. https://doi.org/10.1108/DPM-12-2018-0378.

Tesseur, Wine, Isaac Chaipa, Enida Friel, Luigi Loddo, Sahady Mencia, and Thandolwenkosi Sibindi. 2022. "Reaching millions through multilingual COVID-19 awareness messaging: A case study on the role of translation and cultural adaptation in GOAL's information campaigns." In *Translating Crises*, edited by Sharon O'Brien and Federico M Federici, in press. London; New York, NY: Bloomsbury Academic.

Tierney, Kathleen. 2008. "Hurricane Katrina: catastrophic impacts and alarming lessons." In *Risking House and Home: Disasters, Cities, Public Policy*, edited by John M. Quigley and Larry A. Rosenthal, 119-136. Berkeley, CA: Institute of Governmental Studies Publications.

UNDRR. 2015. *Sendai Framework for Disaster Risk Reduction 2015 - 2030.* United Nations Office for Disaster Risk Reduction (Geneva, Switzerland). https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030.

---. 2022. *Global Assessment Report on Disaster Risk Reduction 2022: Our World at Risk: Transforming Governance for a Resilient Future*. Geneva: United Nations Office for Disaster Risk Reduction.

Volynets, Sofia, Enrico Glerean, Jari K Hietanen, Riitta Hari, and Lauri Nummenmaa. 2019. "Bodily maps of emotions are culturally universal." *Emotion* 20 (7): 1127-1136.

Welle, Torsten, and Jörn Birkmann. 2015. "The World Risk Index. An Approach to Assess Risk and Vulnerability on a Global Scale " *Journal of Extreme Events* 2 (1): 1550003. https://doi.org/https://doi.org/10.1142/S2345737615500037.

Wisner, Benjamin. 1998. "Marginality and vulnerability: Why the homeless of Tokyo don't 'count'in disaster preparations." *Applied Geography* 18 (1): 25-33.

---. 2016. Vulnerability as Concept, Model, Metric, and Tool. In *Oxford Research Encyclopedia of Natural Hazard Science*. Oxford; New York, NY: Oxford University Press.

Wisner, Benjamin, Piers Blaikie, Terry Cannon, and Ian Davis. 2003. *At Risk. Natural Hazards, People's Vulnerability and Disasters*. 2nd ed. London; New York, NY: Routledge.

Wray, Ricardo, Jennifer Rivers, Amanda Whitworth, Keri Jupka, and Bruce Clements. 2006. "Public Perceptions about Trust in Emergency Risk Communication." *International Journal of Mass Emergencies and Disasters* 24 (1): 45-76.

Zhang, Yize, and Carlo Eugeni. 2022. "Evaluating the Efficacy of Relay Interpreters: A Case Study about Interpreting for a Development-Aid Project in Sierra Leone." *International Journal of Chinese and English Translation & Interpreting*: 1-16.