Designing tsunami risk communication with communities: A site-specific case study from Tūranganui-a-Kiwa, Aotearoa New Zealand

Harmony Repia[1]
Jo Bailey[1]

[1] Ngā Pae Māhutonga / Wellington School of Design, Massey University, New Zealand.

Author correspondence:
Jo Bailey
Ngā Pae Māhutonga / Wellington School of Design,
Massey University,
New Zealand.
Email: J.Bailey@massey.ac.nz

Abstract

This paper describes a student research project that proposes ways to build earthquake and tsunami awareness through a community-centred approach to tell the story of tsunami as a potential risk. This project is centred on Tūranganui-a-Kiwa (the Poverty Bay region on the East Coast of Aotearoa New Zealand's North Island), an area close to the Hikurangi Subduction Zone which is liable to produce tsunami with little or no time for an official warning. Recent research has revealed that these coastal communities have low levels of tsunami awareness and high expectations of receiving a formal warning before evacuation. In response, this project examined ways to incorporate Mātauranga Māori with Human-Centred Design to produce a meaningful and relevant narrative for encouraging community conversations about tsunami risk. This approach can increase ownership of risk management and recognises that communities, especially tangata whenua - "people of the land", or indigenous communities who have authority in a particular place - hold various bodies of knowledge that can contribute to future risk management. A combination of methods comprised a co-design process, underpinned by Kaupapa Māori research principles, including developing personas and conducting semi-structured interviews and participatory workshops. A narrative developed through this design process manifested in a sculptural pouwhenua - marker posts, usually carved, that are used to mark boundaries of significant places - articulating local earthquake and tsunami hazards. This speculative output was presented in Wellington and Tūranganui-a-Kiwa and is envisaged as an ongoing conversation prompt. This paper describes and reflects on this research process as one that intertwined Human-Centred Design with the author's own situated knowledge as an emerging Māori design researcher. It suggests that a design process that is responsive to community, geography, and culture, undertaken without a predetermined outcome, is valuable in two ways: for the learning that takes place dialogically through the process itself and the potential for an artefact initiated through this process, which embeds narrative storytelling, to catalyse further dialogue in the community and expert groups and between the two.

Keywords: *Tsunami risk, communication, Human-Centred Design, Mātauranga Māori, community*

Pepeha[1]

Ko wai au	Who am I
I te taha o toku papa	My geneology on my father's side
Ko Titirangi te Maunga	Titirangi is my mountain
Ko Ūawanui-a-Ruamatua te Awa	Ūawanui-a-Ruamatua is my river
Ko Horouta te Waka	Horouta is my canoe
Ko Te Aitanga-a-Hauiti te Marae	Te Aitanga-a-Hauiti is my Marae
Ko Ruakapanga te Whare	Ruakapanga is my ancestral house
Ko Ngāti Porou te Iwi	Ngāti Porou is my iwi
Ko Harmony Repia toku ingoa	My name is Harmony Repia

The *pepeha* of the first author establishes their place in terms of their *whakapapa*, which is generally translated as "genealogy" and can be interpreted literally as "the process of layering one thing upon another" (Mahuika, 2019, p. 1), incorporating relationship with place, land, people, and the wider universe. This is important in situating my connection to Tūranganui-a-Kiwa (the Poverty Bay region on the East Coast of Aotearoa New Zealand's North Island) and my position in this research as an emerging Māori design researcher. The Tūranganui-a-Kiwa area gets its name from the ancestor

---

1 This is the author's *pepeha*, an introductory speech commonly given as part of a *mihimihi* (a Māori formal greeting) that indicates important places and connections and frames a person in terms of their *whakapapa*.

Kiwa, who arrived from Hawaiki on the Tākitimu canoe (Tūpara, 2005). It is the area known as Poverty Bay on the East Coast (Te Tairāwhiti) of Aotearoa New Zealand's North Island and includes the city of Gisborne (formerly called Tūranga). Situated knowledge, a term coined by Donna Harraway in *Simians, Cyborgs, and Women: The Reinvention of Nature* (1991), is the idea that all forms of knowledge reflect the particular conditions in which they are produced, and at some level reflect the social identities and social locations of knowledge producers (Rogers et al., 2013).

Mātauranga Māori refers to the knowledge that Māori have, but also encompasses the Māori way of knowing and the connectedness that knowledge has with the environment out of which it was derived (Goodall, 2016). It has been observed that the science (and science communication) community in Aotearoa is on an ongoing journey towards understanding Mātauranga Māori (Fleming et al., 2020) and appreciating it as a "way of knowing" that, though subjective, is no less legitimate or complete than empirical science. In my experience, the field of design is also on a journey beyond adopting Māori motifs and *tikanga*[2] as a cultural veneer to recognising its holistic importance. However, it would be disingenuous to characterise this research as utilising an overt and specific Kaupapa Māori methodology from the outset (though elements adopted do share commonalities with models such as *negotiated space*, conceptualised by Hudson et al., 2012 , which models the interface between science and Mātauranga Māori). Rather, this research ran in tandem with my own developing appreciation of the synergies and commonalities between Human-Centred Design and the holistic, intertwined relationships between land and living things (fauna, flora, human, spiritual) inherent in Mātauranga. This awareness developed during the research process, informed by the work of Linda Tuhiwai Smith and others (2012; Te Rau Ora, 2017).

This paper focuses more on presenting the process undertaken in this project with important considerations for those wishing to do similar rather than detailed findings from each stage of the research. However, the final outcome of the project is discussed. As such, this paper first introduces the context of the research and then moves through the different stages of the employed design process, concluding with a discussion of the process.

Open Call for Research

In 2015, research identified that coastal communities in Aotearoa New Zealand's North Island did not sufficiently understand tsunami risk (Dhellemmes et al., 2016). As part of the response to these findings, a research project supported by GNS Science and the Joint Centre for Disaster Research (JCDR) hosted at Massey University was proposed to explore novel and creative ways of communicating these natural hazards. An open call was put out for student applicants to undertake this research, based within the Massey University School of Design. My position as a designer, a researcher, and a member of an affected community gave me a unique perspective from which to explore this issue of low understanding of tsunami risk. I was selected to carry out this research as a 1-year Master's of Design (MDes)[3] project by the selection panel from JCDR, GNS Science, and the Massey University School of Design. Though location was not specified in the project brief, I proposed a focus on my own home region, a place I consider my *tūrangawaewae*: translated as "standing place; belonging through kinship and whakapapa" (Te Ipukarea, n.d.e., Definition 1).

Tūranganui-a-Kiwa is situated close to the offshore Hikurangi tectonic plate boundary, potentially the largest source of earthquake and tsunami hazard in Aotearoa (East Coast LAB, n.d.). As well as the possibility of locally generated tsunami, the area is vulnerable to tsunami generated regionally and from more distant sources around the Pacific Rim. In my community, we live with a general background awareness of our vulnerability to tsunami; I have experienced tsunami warnings first-hand. However, Dhellemmes et al.'s (2016) research found that coastal communities have high expectations of receiving a formal warning to evacuate in the event of a tsunami even when no official warning is likely. For instance, for a tsunami expected within an hour, 73% of respondents expect to hear "warning sirens" and 74% expect "radio or TV announcements", compared to just 53% who expected to be warned by "feeling an earthquake". In some circumstances there would not be time for a warning through official channels, and communication from the media would not provide the community with enough notice to protect our *whānau*,

---

2   *Tikanga* is a series of rules or customs that are passed down from *tūpuna* (ancestors; Kilgour, 2014).

3   An MDes is a Master of Design postgraduate degree considered equivalent to MA or MSc degrees in other disciplines. It is completed by thesis, which incorporates a "design response" (such as a prototype product) and a written exegesis. Master's of Design research titled *Niho Taniwha: Communicating Tsunami Risk. A site-specific case study for Tūranganui-a-Kiwa* and is available online at http://nihotaniwha.makinggood.design/

hapū, and *iwi*[4]. In addition, over 70% of the respondents indicated that they "talked about tsunami" at a frequency of "never" or "once per year or less" and over 86% of respondents "get information about tsunami" at the same frequency. These findings suggest that the current communication centred around the "long or strong, get gone" message (NEMA, n.d.) is not resonating sufficiently with communities for them to fully register the information and provoke dialogue. These findings aligned with my personal experience in Gisborne (a large town in Tūranganui-a-Kiwa).

Research Approach

Indigenous knowledge. My research embraces a shift from western knowledge frameworks towards an indigenous knowledge approach in which Māori values, customs, and indigenous perspectives must inform the basis of research that involves Māori communities. Indigenous peoples share a long-standing connection to their land, community, and natural environment that is maintained through an understanding of practices of belonging, knowledge, and responsibility (Wilson, 2008). Western knowledge is separated into distinct categories such as science, art, and religion, with disciplines disconnected from each other and privileged for this specificity, individualised authorship, and stratification within distinctly western values (Wilson, 2008). Indigenous knowledge on the other hand springs out of the integration of those areas and maintains inter-relationships that reflect a holistic understanding of the world. Pihama et al. (2015) give an example from their own cultural knowledgebase that indicates science and culture are not separated. They describe the navigational expertise of tūpuna Māori who travelled across the Pacific Ocean, highlighting a strong understanding of water-related sciences like ocean swells, tides, and sea movements. Māori have generated different names for these phenomena that tell people about the myriad characteristics, shapes, and nature of an energy that can uphold life but also bring destruction (Royal, 2006). This energy, with all of its forms, moods, and expressions, is known as *Tangaroa*[5].

Through narrativised knowledge, Tangaroa, a *kaitiaki* (guardian) of the ocean is considered an *atua* (ancestor or spirit). Atua have personality, a spiritual self, and a genealogical network where aspects are employed for describing relationships, situations, and events in order to transmit knowledge in memorable ways. These stories assist in passing on information about tasks such as fishing, navigation, and seasonal planning. Within a wider understanding, these narratives bind, link and inter-relate both the land (the underlying sea beds and the continental shelves) and all marine and bird life to the environment and further beyond into the cosmos. In a further example, Hikuroa (2017) shows that Mātauranga Māori can codify risk through *pūrākau*, a traditional form of Māori narrative containing philosophical thought, epistemological constructs, cultural codes, and worldviews (Lee, 2009). They encapsulate and condense into easily understood forms Māori views of the world, ultimate reality, and the relationship between the atua, the universe, and humans. In traditional Māori society, pūrākau were important for teaching, learning, and intergenerational transfer of knowledge (Hikuroa, 2017). Hikuroa gives the example of a *taniwha*[6] in the form of a *ngārara* (lizard) at Waitepuru stream in Eastern Bay of Plenty, which flicks its tail from side to side. Hikuroa (2017) explains how there are simultaneous literal and metaphorical strands to the story: allusions to geomorphology in terms of the placement of the taniwha in relation to the river course and the flicking tail suggesting hazards around the stream. As a result, the pūrākau intertwines and codifies knowledge about both geomorphology and disaster risk reduction. Therefore, an indigenous paradigm comes from the fundamental belief that knowledge is relational (Wilson, 2008). Considering research as relational entails understanding not only these interrelationships, but how research is formed, planned, and carried out.

Community and place-based knowledge. King et al. (2007) suggest that allowing the community to share responsibility for their response to an unfolding crisis opens up new opportunities to raise awareness. My research sought to uncover this potential and to bring to the fore bodies of local knowledge that could inform a response pertinent to the local context and the community's need to raise tsunami awareness. Encouraging community participation is not in itself novel. The disaster risk reduction (DRR) field, especially in a development context (Le De et al., 2015), has looked to community knowledge to bolster DRR planning, utilising tools such as participatory mapping (Cadag & Gaillard, 2012). There are also examples of DRR seeking to

---

4   *Whānau*, *hapū*, and *iwi* are Te Reo Māori terms that describe tribal groupings. The largest is iwi, which is often translated as people or tribe (Te Ipukarea, n.d.a). Hapū is a smaller social grouping or clan that forms a subsection of an iwi while whānau refers to extended family groups (Taonui, 2005).

5   *Tangaroa* is sometimes described as god of the sea (Royal, 2006).

6   *Taniwha* is translated as "water spirit, monster, dangerous water creature, powerful creature. Regarded as guardians by the people who live in their territory but may also have a malign influence on human beings." (Te Ipukarea, n.d.c., Definition 1).

integrate indigenous knowledge (Mercer et al., 2010). Design also has a long legacy of community participation, with Participatory Design emerging in Scandinavia in the 1970s, starting from "the simple standpoint that those affected by a design should have a say in the design process" (Bjögvinsson et al., 2012, p. 103).
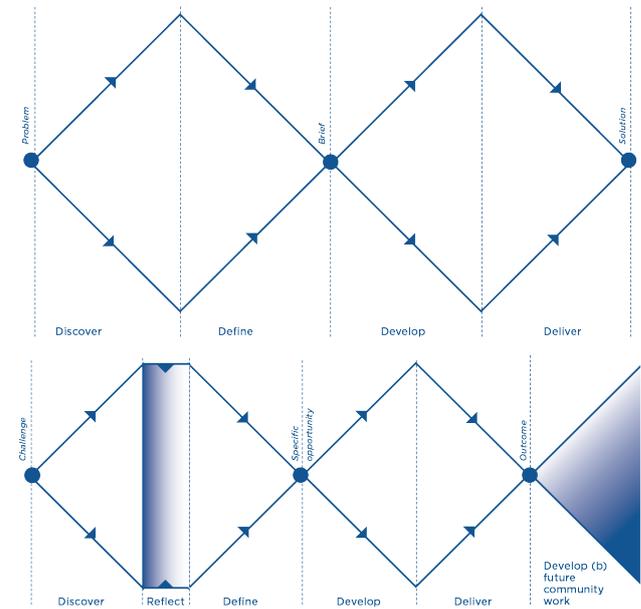
I recognise these schools of practice as knowledge threads that informed me but situate my approach in a different context. I was guided by Mātauranga Māori (through my own indigenous perspective and engagement with scholars and community) alongside Human-Centred Design methodologies (Baker III & Moukhliss, 2020; Giacomin, 2014). My training as a designer incorporates co-design methods (Sanders & Stappers, 2008) to build empathy with my community around shared experiences of tsunami warnings. In different ways, both Mātauranga Māori and Human-Centred Design emphasise intricate, holistic, and interconnected relationships between people and their environments. This blending of approaches helped the underlying problems affecting tsunami awareness and preparedness in Tūranganui-a-Kiwa become visible to me.

Human-Centred Design. Human-Centred Design is an integral part of *design thinking*: a problem-solving approach which reduces a number of broad design methods into a framework for addressing novel challenges in a variety of settings (Baker III & Moukhliss, 2020). Key to Human-Centred Design is "involving and centring the design process around observed and inferred user needs" (Baker III & Moukhliss, 2020, p.309).

Human-Centred Design is grounded in empathising with and understanding the needs and insights of the people for whom the designer is designing, to bring clarity to the underlying problems affecting their communities or the situation that an individual may inhabit. This provides the opportunity for designers exercising a Human-Centred approach to drive creative thinking and offer innovative proposals relative to the situation being considered. The core value of Human-Centred Design recognises that the "people who face those problems every day are the ones who hold the key to the answer" (IDEO, 2015, p. 9). Human-Centred Design is not a one size fits all process, nor is it perfectly linear. Each project brings different perspectives, context, and knowledge that in turn navigates its own contours and character, diverging and converging (IDEO, 2015) as knowledge and ideas are gathered, synthesised, iterated, and refined.

Figure 1

The Double Diamond Model

Note. The top model shows the standard Design Council (n.d.) "Double Diamond" model while the other model is the adjusted version used for the design process in this research project.

I used the Double Diamond model (UK Design Council, n.d.) to structure my design process. The model has four phases: Discover, Define, Develop, and Deliver. In essence, the first diamond is about understanding the issue to identify the problem while the second diamond addresses the ways solutions could manifest. It is necessary to go through the process of the first diamond to offer solutions to the right questions. The Double Diamond framework, presented in Figure 1, was adapted in this research to better understand my audience by taking the time to build stronger relationships and connections with them. The Human-Centred Design process, underpinned by Mātauranga Māori, manifested in this research with the activities presented in Figure 2.

Process

Design Process: Discover

My initial focus was to understand the most recent advice from emergency management experts regarding tsunami hazard and risk at the Hikurangi Plate Boundary and the communication currently carried out by stakeholders such as East Coast LAB and Te Tairāwhiti Civil Defence Emergency Management (CDEM).

Multiple communication methods inform the public of tsunami risk in Aotearoa; there is a need to integrate expert knowledge sources (via mass media

Figure 2

Phases of the Double Diamond

Discover	Define	Develop (a)	Deliver	Develop (b)
Broad phase of secondary research on risk communication, local tsunami risk, extant tsunami awareness and Mātauranga Māori perspectives on tsunami risk. Gathering data and insights that will inform the rest of the design process. Connection with scientists, emergency management and indigenous knowledge experts.	Questionnaire to identify potential participants and broad themes for subsequent phases disseminated through whānau and civil defence networks, leading to kanohi ki te kanohi (face-to-face) semi-structured interviews. Synthesis into 'personas' (composite people to define audience attitudes and needs) to frame the design challenge.	Co-design workshops with the community to generate ideas through participatory asset mapping, sharing stories, and building narratives, and initial design development.	Development of the pouwhenua and initial presentation to Te Tairāwhiti CDEM.	Possible future work with communities to bring the pou back for further conversations.

Hui with indigenous scholars	*Interview data collection*	*Co-design workshop*	*The pouwhenua output*	*Back to Tūranga*

communications) with informal social interactions (e.g., conversations with neighbours). The importance of doing so recognises that local sources of information typically resonate better with the public because they are more personalised (Brenkert-Smith et al., 2012).

The Tūranganui-a-Kiwa region of the East Coast is close to the plate boundary between the Pacific and Australian tectonic plates. Being a subduction-type plate interface, this area has the potential to produce large earthquakes and associated tsunami. Furthermore, the East Coast of Aotearoa is exposed to tsunami generated from around the Pacific Rim (Borrero & Bosserelle, 2019). Current local messaging from Te Tairāwhiti CDEM, informed by tsunami inundation assessments (Borrero & Bosserelle, 2019) and modelling (Power et al., 2016; Power et al., 2018), specifies that the Tairāwhiti region "is vulnerable to tsunami of any size at any time" (Gisborne District Council, n.d., para 1) and highlights that a tsunami may be local, regional (e.g., Kermadec Islands, with around an hour of warning), or distant-source (e.g., originating near Chile or Peru, with around 11 to 15 hours warning).

Public advice follows the national "Long or Strong, Get Gone" messaging (NEMA, n.d.), with Te Tairāwhiti CDEM emphasising to "use the natural signs as our warning, self-evacuation is the only option" for a locally generated tsunami. This messaging is available via print materials and online (including social media). In terms of communications that utilise a specifically creative approach, incorporating indigenous knowledge, Hawke's Bay Emergency Management Group developed a children's book called *Rūaumoko's Walk* to communicate the importance of knowing the natural warning signs of tsunami (Andrews & Graham, 2014). *Rūaumoko's Walk* is a bilingual (English and Te Reo Māori) book based on Ngāti Kahungunu legends relating to local hazards. It utilises a Māori understanding of the relationship between earthquakes and tsunami whilst highlighting the actions needed to get to safety through storytelling.

The research that catalysed this project and articulated the problem I was seeking to address was the June 2015 survey undertaken by GNS Science and the JCDR (Dhelemmes et al., 2016). This survey provided some indication of how Tūranganui-a-Kiwa perceived tsunami risk. Coastal communities along the East Coast

of Aotearoa appeared to have low levels of tsunami awareness and high expectations of receiving a formal warning before evacuation. Quantitative and qualitative data highlighted that even though residents understood they lived in a coastal community prone to tsunami, they were not necessarily prepared for a tsunami situation. In particular, the data collected from Wainui, a suburb in Tūranganui-a-Kiwa, identified that although residents expect an earthquake to warn them of a local tsunami (the key message of recent civil defence campaigns) there is still a large proportion of residents who rely on a mixture of communication methods like radio and TV announcements, word of mouth, and warning sirens. A qualitative study with the community of Pauanui on the Coromandel Peninsula of Aotearoa identified similar behaviours to Tūranganui-a-Kiwa (Couling, 2014). Pauanui participants relied heavily on receiving a formal warning (via sirens) in response to the 2009 Samoa tsunami and did not have an accurate perception of tsunami risk or an understanding of the appropriate actions to take.

Risk communication generally has evolved to focus on enhancing conversations between technical experts and publics with the purpose of communicating hazards and managing risk in ways that are easy to understand. This mirrors the general shift in science communication from top-down *deficit model* communication to dialogical approaches that enable informed decision-making by the audience: "the gradual shift in policy discourse from keywords such as 'popularisation' and 'public understanding of science' to 'dialogue', 'engagement' and 'participation'" (Bucchi & Trench, 2008, p.3).

Having developed a sense of the communication landscape and the needs highlighted by Dhellemmes et al. (2016), I shifted to focus on understanding Mātauranga Māori perspectives in relation to tsunami through pūrākau. King and Goff (2010) highlight written records that tell of destructive waves caused by taniwha that endanger the lives of people in coastal communities. Although taniwha in these stories appear to be hostile, McFadgen (2007) considers them to be neutral and only aggressive when described in pūrākau involving events that cause damage or fatalities. King and Goff share that taniwha were usually associated with areas of risk and were used to explain natural hazards like a rapid in a river; pūrākau of these taniwha were told as a warning. I began to look into the history of my own iwi in search of localised tsunami pūrākau, including "Te Tai o Ruatapu", which describes how Ruatapu sent great waves to destroy his half-brother Paikea after being shamed by his father Uenuku (Taumaunu, 2001). However, as much as I appreciated researching this pūrākau in academic texts, I felt the need to talk to local people to acknowledge their specific perspectives relevant to their iwi's understanding of the narrative. I sought to connect with local experts about "Te Tai o Ruatapu" using my own whakapapa connections but found that, because I was still in the discovery stage of my research, I had not laid a strong enough foundation. This highlights that just because I am Māori and whakapapa back to Tūranganui-a-Kiwa did not mean I would be immediately accepted, or have an understanding at an acceptable level, to research iwi pūrākau. As a result, I decided to stay open to the idea of pūrākau but steered towards understanding new narratives that could be developed by a community to understand tsunami risk.

Design Process: Define

The Define phase aimed to synthesise the learnings from the Discover phase with my own qualitative primary research in the Tūranganui-a-Kiwa community. The target audience for this research originally included all of Te Tairāwhiti, but through conversations with Te Tairāwhiti CDEM, I found that smaller communities along the East Coast were already seen as exemplars of self-policing (P. Stuart, personal communication, 2017). Rural communities are exposed to events like road closures, flooding, or being cut off from power due to severe storms which has required them to take extra steps to prepare for such events. This insight led to a closer focus on the urban community.

Initially, I used a questionnaire sent via my whakapapa channels, social media, and Te Tairāwhiti CDEM. The questionnaire was titled "Local Hazards in your Local Area" so that tsunami was not prompted as the initial focus and was used to give me a broad view of my community's perspectives on natural hazards to help inform further interactions. The questionnaire also functioned as a way to locate and screen participants for more in-depth discussion, ensuring a range of awareness and preparedness, demographics, and geographic locations were included in my interview range.

I conducted 12 *kanohi ki te kanohi* (face-to-face) semi-structured interviews to offer a qualitative dimension to complement the existing research and my questionnaire. These were held at a café close to one of Tūranganui-a-Kiwa's well-known beaches, providing a space that was comfortable and familiar for my interviewees but also had relevant meaning to my interview questions. Common themes that came out of the interviews included:

– Low levels of understanding of the different types of tsunami (local, regional, and distant source).

– Confusion around how strong an earthquake needs to be before evacuating for a tsunami.

– Strong emphasis on waiting for a formal warning before evacuating, mostly from Ngati Porou Radio station, Te Tairāwhiti CDEM, or "the siren".

– National messaging did not resonate with respondents because it lacked context to Tūranganui-a-Kiwa.

– When presented with images of CDEM campaigns, participants wanted to know more about the effects tsunami could have on their own region and what they needed to do to prepare[7]. They were more interested in local knowledge as opposed to general messages on the TV.

– There is a lack of urgency to react to tsunami warnings because past warnings have not resulted in a discernible tsunami, so are viewed as "false warnings".

– Local narratives provide an effective way of understanding natural hazards specific to this community, land, and place.

7   Subsequent to my research, granular local inundation and evacuation maps informed by the latest tsunami inundation assessment, (Borrero & Bosserelle, 2019), with safety zones for local and distant tsunami, were produced and disseminated (Gisborne District Council, n.d.). This may go some way to equipping the community with the local situational knowledge they sought.

As well as providing specific local insights, the interview responses were synthesised into three personas (Martin & Hanington 2012, p.132): "Gina", "Rāwiri", and "Ashleigh" (Figure 3). These are composite fictionalised people with associated behaviours, wants, needs, and attitudes representing identifiable groups within the community (Open Design kit, n.d). The process of developing personas and associated problem/insight statements helped me to identify with the community of Tūranganui-a-Kiwa and keep them in mind throughout. Through this process, I also framed a series of *how might we* statements (Open Design kit, n.d). These are designed to suggest that a solution is possible without proscribing a particular answer, so they act as a "frame for innovative thinking" (IDEO, n.d., para 1). These included:

– How might we create relatable content for youth using visuals and technology to increase tsunami awareness?

– How might we encourage the community to share experiences of tsunami preparedness through family orientated activities?

– How might we empower whānau and friends to build relationships with their iwi/hapū/whānau as an entry point to discussing tsunami preparedness and awareness?

Figure 3

Distilled Personas Based on the Interview Process

Gina

Gina needs a way to feel empowered that she is making the right decisions for her family, but the social connections with her friend and whānau network is not exposing to her the information that she needs.

Needs and insights:

— Equip me with practical tools to share/discuss with my friends and family
— Build a relationship with me through my work or hapū/iwi
— Tell me what I need to do and where to go in a natural disaster

Rāwiri

Rāwiri needs a way to feel enlightened about preparing for a natural disaster but unfortunately the exposure that he's had to tsunami awareness information fails to relate to him personally, which leaves him feeling disengaged.

Needs and insights:

— Visualise for me scenarios of how to evacuate and where to go
— Interact with me in person through community events or school
— Share with me new innovative ways of being prepared step by step via a digital platform

Ashleigh

Ashleigh needs a way to participate in tsunami education that is fun for her and her family as well as connecting her to people. But what puzzles her is that no one in her community wants to share their experiences and she worries if people know what to do.

Needs and insights:

— Educate me and my children about natural disaster information in a fun interactive environment
— Connect me with people in my community who are interested in natural hazard preparedness
— Explain/Involve me in how you are going to help people in my community prepare and plan

Note. These personas centre wants, needs, and attitudes rather than demographics.

Design Process: Develop

This phase utilised co-design workshops where I encouraged people to share their stories and experiences by mapping them to their local environments. In the workshops there were three activities to generate ideas for design responses: participatory asset mapping, sharing stories, and building narratives.
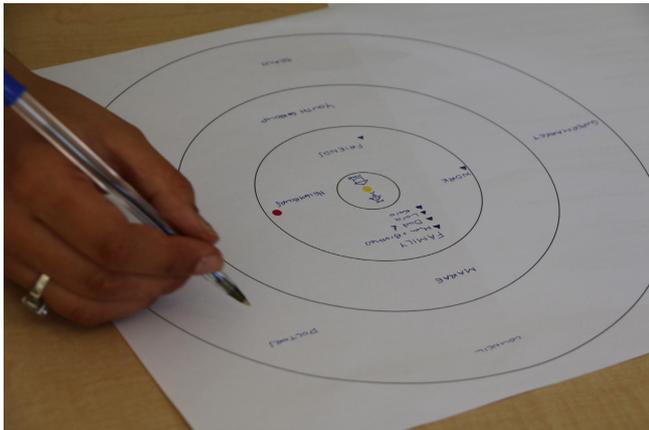
Participatory asset mapping. Participatory asset mapping combines *participatory mapping*, where community members geographically identify their own people, places, and experiences, with *asset mapping*, identifying community assets like behaviour, knowledge, and skills that support resources for individuals and collective groups in a community (Janice et al., 2012). Participants were asked to illustrate a tsunami warning response by documenting important

Figure 4

Participatory Workshop: Asset Mapping

locations, people, and places that could inform their decision making. For example, the centre circle (see Figure 4) communicates the most important people, places, and/or experiences to consider when responding to a tsunami warning. The outer circles are important to consider but may not be crucial when preparing for a natural hazard event. Participants were encouraged to share their asset maps in a group to discuss how they would respond to a tsunami event and individual maps were combined. This generated considerable discussion between participants and visualised areas of importance as well as whānau structures and how these needed to be incorporated into planning for a tsunami emergency.

Sharing stories. In the second exercise I invited the community to share their experiences with earthquakes and tsunami warnings using story cards, colour-coded by theme for earthquake, tsunami, time, and response (see Figure 5). The colour system was used as a way to break down the information collected during the sharing
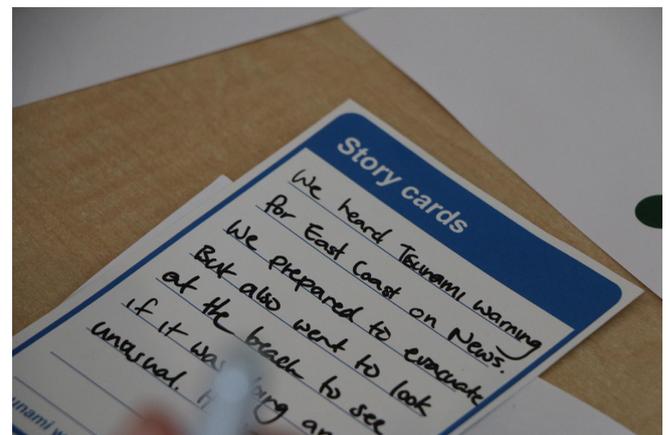
process and in the analysis phase where I could step back and see the coloured trends. The purpose of this exercise was to share people's responses to earthquakes and tsunami through a directed storytelling process (Martin & Hanington 2012), and to gather insight into whether or not participants were aware that a local tsunami could be triggered by a local earthquake and could require an evacuation response time of less than 15 minutes. Story cards were then added to a map of the Tūranganui-a-Kiwa region, which acted as a canvas for contextualising my participants' stories.

Building narratives. Participants were asked to build tsunami communication structures using printed words that I had gathered through my research process to prompt conversations about design, science, tsunami, and local knowledge (see Figure 6). The idea of discussing narratives and "layering" tsunami/earthquake experiences using physical materials (e.g., cardboard boxes, words, papers, and pens) let the participants

Figure 5

Participatory Workshop: Story Cards

Figure 6

Participatory Workshop: Building Narrative Structures

build speculative tsunami communication prototypes. The layering process builds on my understanding of whakapapa: layers of generations and information. Prompting participants with a selection of pre-selected words helped centre conversations around topics such as tsunami, earthquakes, preparation, geography, and whānau. Participants were also encouraged to write their own words and to use only what felt relevant to them.

Each group contributed, discussed, and negotiated ideas, building their own tsunami communication structure while sharing and extending their own knowledge. As the facilitator, I encouraged each team to utilise the data collected in the previous exercises to drive the rationale behind their designs. At the end of the exercise each team reflected back to the group their own ideas. Concepts that were captured in their tsunami communication structures included:

– Different stages of responding to a tsunami event represented in the different levels of the structure: Confusion (low) > Organised (medium) > Connected (high);

– Navigation by an alert and showing directions;

– Using light as a beacon;

– Community engagement through schools and acknowledging local knowledge;

– Communicating information by using the structures to talk to one another;

– Colour to identify which area of risk you are in (e.g., safe or danger zones);

– Embedding scientific information in the structures; and

– The idea of sound and colour is connected to atua (e.g., the cracking of Rūaumoko, the Māori ancestor/atua of earthquakes and volcanoes).

Collaborating with my community through co-design enabled this research to develop meaningful new narratives. Just as importantly, the workshops themselves enhanced community conversations about tsunami risk in Tūranganui-a-Kiwa, which in itself is a valid and useful tsunami risk communication exercise.

Design Process: Deliver

Pouwhenua. Participants in the workshop sought to utilise local knowledge, beacons of light, and atua in their structures to communicate tsunami risk. They continued to discuss the importance of the whenua and their relationships to it; *kaitiakitanga* (guardianship) as a principle for tsunami communication emerged. This manifested in their ideas to illuminate structures with light (beacons) that navigate you to safety like a
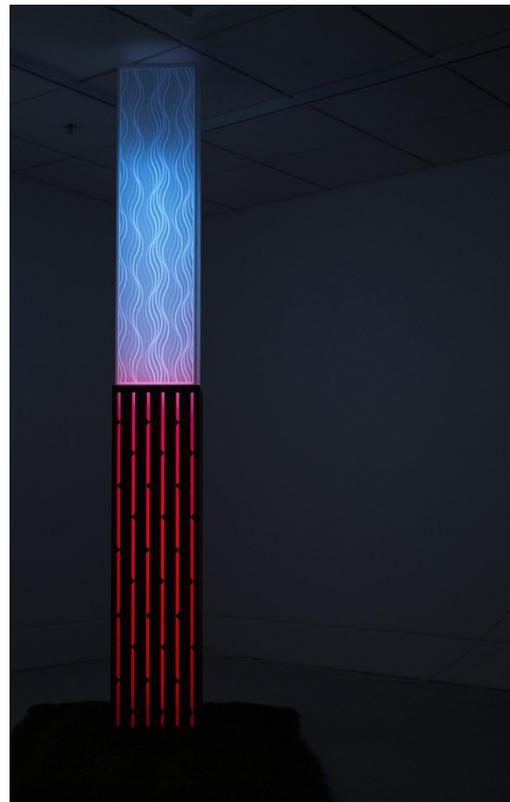
Figure 7

Pouwhenua Light Installation

kaitiaki (guardian, steward) or an atua. My participants' connection to the land and their own whakapapa and understanding of kaitiakitanga are embedded in the structures they created. Local knowledge and the concept of atua and beacons of light became central to my pouwhenua prototype as well, evolving and amalgamating their knowledge and expression with mine as part of the iterative design process. The workshop exercises encouraged me to explore pouwhenua, which in Māori tradition are boundary markers or land

Figure 8

Pouwhenua Light Installation

posts denoting areas or territory. This, I felt, could be extrapolated to denote safe and unsafe zones for tsunami risk. As a result, the design, an interactive sculptural pouwhenua featuring light and pattern, emerged in response to the knowledge from the development process (Figures 7 and 8).

In Māori tradition, Papatūānuku (or "Papa") is the "earth mother". Tangaroa and Rūaumoko, atua of the ocean and atua of earthquakes, are two of her children. These atua are reflected in the narrative of my pouwhenua that recognise Papatūānuku as the continental shelf with Rūaumoko and Tangaroa represented as the earthquakes and tsunami we have experienced in Te Tairāwhiti (see Figure 9).

Papatūanuku's relationship with the earth moving may refer to the Hikurangi Subduction Zone where the two plates are currently locked. When the energy and pressure is built up over time the release of that energy may be seen in large subduction earthquakes that could trigger a local tsunami. In the design of the pouwhenua, Papa is represented by a pressure plate under foot that activates a narrative of light when pressure is applied.
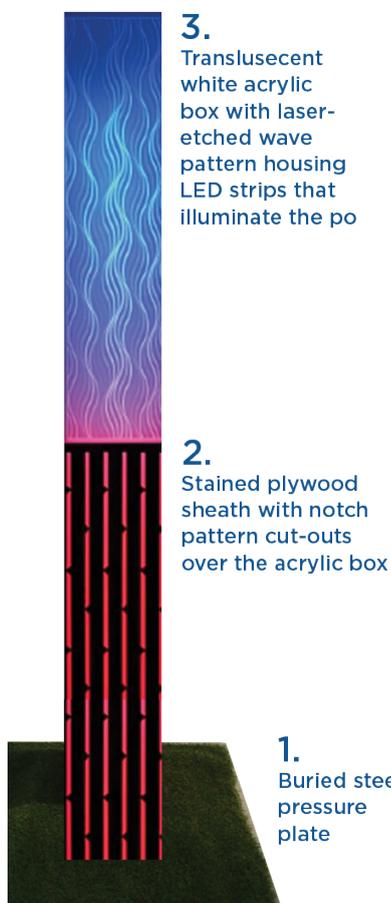
That narrative is the relationship between Papa's movement and the movement of Rūaumoko which causes Tangaroa to react. Rūaumoko is represented in the bottom half of the pouwhenua, which is adorned with the pattern *niho taniwha* ("The Teeth of the Taniwha"). In my initial research, I came across pūrākau that tell of taniwha being a metaphorical understanding of tsunami risk in coastal communities. Therefore the niho taniwha pattern embeds this Mātauranga into the pouwhenua,

Figure 9

Mātauranga Māori Articulated through the Pouwhenua

Niho Taniwha
Interactive pouwhenua

3.
Translusecent white acrylic box with laser-etched wave pattern housing LED strips that illuminate the po

2.
Stained plywood sheath with notch pattern cut-outs over the acrylic box

1.
Buried steel pressure plate

1. Papatūanuku
Papatūanuku (earth mother) and the locked plates of the Hikurangi Subduction Zone where pressure might be building is represented by a hidden pressure plate under the ground surface. A person steps on the plate, and this activates a 'local earthquake' shown through a light and colour sequence...

2. Rūaumoko
Rūaumoko (atua of earthquakes and tsunami) is represented in the bottom half of the pouwhenua, which is adorned with the notched 'niho taniwha' pattern. Once Papa is activated, the pou illuminates in red to indicate Rūaumoko's awakening...

3. Tangaroa
Tangaroa (atua of the ocean) is depicted in the top of the pou with a wave pattern. Once Rūaumoko is activated the ocean carves into the land, which is shown by a coloured animated light sequence. This moves up and down the pou several times depicting the transition of energy from Rūaumoko to Tangaroa as a tsunami that can inundate and recede rather than being a single big wave.

Phase 1: unlit

Phase 2: the earth awakens

Phase 3: the water moves

Note. This figure presents the three elements and states of the pouwhenua and their embedded meanings.

exposing the risks of earthquakes and their relationship to tsunami.

The upper half of the pou is Tangaroa's domain where I have used a wave pattern to signify the water carving into the land as a tsunami might do. The *mauri* (life force) of the pouwhenua is awakened when a person stands on the pressure plate, simulating how seismic forces may trigger tsunami in a real event. The release of energy becomes a metaphor for understanding the relationship between an earthquake and tsunami or the movement between Papatūanuku (shifting plates), Rūaumoko (earthquakes), and Tangaroa (ocean). The energy of Rūaumoko erupts from the bottom half of the pou with a red light (volcanic energy) that transitions into a blue light (ocean energy). The pou then cycles through that transition of energy from Rūaumoko to Tangaroa multiple times indicating that a tsunami wave can inundate and recede numerous times.

Discussion

The aim of the design was to encourage people to interact with the narrative of the pou, to raise awareness and enhance conversation around tsunami risk. This pouwhenua is a passive communication reminder that is specifically connected to the whenua of Tūranganui-a-Kiwa. The pouwhenua embeds the knowledge that an earthquake is the warning for tsunami and utilises the narratives of cultural memory that are embedded in the whenua. This research shifts away from the design of a traditional pouwhenua by adding digital elements of light and interactivity triggered by pressure applied to a base plate in the ground. Tangata whenua can interact and visualise the energy and mauri of our atua, which brings a new meaning to the narratives contained in pouwhenua.

The pou was not a prototype in the sense of a model to rigorously explore technology, materials, or physical attributes, but rather a speculative prototype to discuss the idea of having community identify, generate, and weave narratives into a design response: in this case, a digital "sculpture" that could have a practical application as a signage device, or simply as a catalyst for conversation. From a design industry point of view, the artefact (and the process that "grew" it) were recognised with a gold "Best Award" from the Designers Institute (DINZ, 2018; Peters 2018). As part of the delivery phase the pou was presented back to the community at Te Tairāwhiti CDEM and to wider groups during its presentation and examination for the requirements of the MDes. During that process, conversations between

participants, their whānau and friends, and also with the expert stakeholders suggested that the pou could act as a beacon around which talking about the narrative, observed and experienced through the interactive visual elements, could become a gateway to discussing preparedness.

The cultural base of this research was underpinned by three Māori principles:

– whakapapa (kinship),

– kaitiakitanga (guardianship), and

– tino rangatiratanga (self-determination).

These principles provided a framework for ensuring that, both culturally and ethically, the outcomes of this research were community driven.

My whakapapa to Tūranganui-a-Kiwa presented an opportunity to explore the local narratives of tsunami awareness and preparedness within my community. I learned that as a Māori design researcher, time was crucial to building relationships and whakapapa connections including with GNS Science, JCDR, Te Tairāwhiti CDEM, and other agencies that informed this project. Reflecting back on the design process, simply being Māori did not grant me access to be an insider as a researcher. In fact, my kinship and whakapapa to Tūranganui-a-Kiwa requires strengthening by forming healthy ongoing engagement with Māori in my community.

My approach to recognising the local knowledge of Tūranganui-a-Kiwa is not only examined in my Human-Centred Design process as a way of empathising and collaborating with my community but by Mātauranga Māori revealing that the stories shared on behalf of my community are *taonga*[8]. My role as a Māori design researcher transformed into the role of kaitiaki, the new caretaker of the narratives shared by my community, along with which goes a responsibility to uphold the *mana*[9] of the stories by protecting them and sharing them appropriately.

Limitations and Future Research

This project was undertaken as part of a 1-year Master's degree which led to challenges of time in relation to building the relationships of trust, respect, honesty, openness, and integrity that need to emerge through a

8   *Taonga* means treasure, to be of value including socially or culturally valuable objects, resources, phenomenon, ideas, and techniques (Te Ipukarea, n.d.d).

9   *Mana* is a supernatural force in a person, place, or object. Including but not exclusive to: prestige, authority, control, power, influence, status, spiritual power, and charisma (Te Ipukarea, n.d.b).

process of engagement, not via a regimented timetable. This is particularly relevant in Māori and other indigenous communities, and though my whakapapa connections may have opened doors, they did not afford me the right to do this work without first establishing these relationships. This time limitation has meant that follow-up activities with the community have been limited, though the pouwhenua has been gifted to JCDR as a beacon and conversation catalyst for future work.

Having undertaken a process with community participants who were a cross section of Māori and *Pākehā* (a non-Māori New Zealander), it was clear that not everyone had a shared cultural environment. In the workshops, Māori participants shared stories and explained to non-Māori participants the relevance and meaning of, for instance, taniwha, and all participants talked about their relationship with specific places in Tūranganui-a-Kiwa. Through this process, new narratives based on the shared local context grew organically from the group in a way that was meaningful for them across cultural contexts. In terms of the pou as an object, further research might uncover if it remains meaningful when viewed from, or transposed to, a different context, a consideration that Witehira and Trapani (2015) discuss in a design context. Does culturally-specific design bring elements of universal value? Anecdotal feedback gathered from the CDEM stakeholders, and the recognition from the design community (DINZ, 2018), suggests that it does, though this is an area that warrants further research.

Conclusion

This research set out to acknowledge the diversity of perspectives within whānau, iwi, and hapū to produce meaningful and relevant narratives to enhance community conversations that raise awareness of tsunami risk. In risk communication, the need to integrate expert knowledge with informal social interactions to personalise information is well established (Brenkert-Smith et al., 2012). Therefore, the people of a community can be the central source of knowledge when it comes to designing new tsunami communication warning systems. Mechanisms like interviews, workshops, and *hui* (meeting or gathering) throughout this research enabled a space for my community to assert their own autonomy (tino rangatiratanga) and identified the need to integrate local knowledge into risk management for Tūranganui-a-Kiwa. *Manaakitanga* (hospitality) was key to encouraging my community to share their own responses to tsunami awareness and preparedness by using Human-Centred Design methods like asset mapping, story cards, and

prototypes to facilitate conversations that support and showcase indigenous perspectives.

As a result, this design-led research proposed the idea of designing a pouwhenua that integrates Mātauranga Māori, local knowledge, and science related to tsunami. A narrative was built through an indigenous understanding of phenomena that tell people about the different forms, shapes, and nature of an energy and expressions that can be seen in a Māori understanding of atua (Royal, 2006). The atua represented in the final pouwhenua describe the relationship between Papatūanuku, Rūaumoko, and Tangaroa, or an earthquake triggering a tsunami, and that the shaking is the warning to evacuate.

Embedding a narrative that responds to traditional knowledge of place may transmit this knowledge in memorable ways. The final pou acts as a catalyst for further discussion and in turn can enhance community conversations that raise awareness of tsunami risk and inform new tsunami communications for Tūranganui-a-Kiwa. The process described here provides a template for how this approach could be employed and/or adapted elsewhere.

Acknowledgements

References

Andrews, R., & Graham, J. (2014). *Te Hīkoi a Rūaumoko - Rūaumoko's Walk*. Hawke's Bay Emergency Management Group. www.hbemergency.govt.nz/assets/Documents/Education/Ruaumokos-Walk-Te-Hikoi-a-Ruaumoko.pdf

Baker III, F. W., & Moukhliss, S. (2020). Concretising design thinking: A content analysis of systematic and extended literature reviews on design thinking and human-centred design. *Review of Education, 8*(1), 305–333. doi: 10.1002/rev3.3186

Bjögvinsson, E., Pelle, E., & Hillgren, P.-A. (2012). Design things and design thinking: Contemporary participatory design challenges. *Design Issues, 28*(3), 101-116. doi: 10.1162/DESI_a_00165

Borrero, J. C., & Bosserelle, C. (2019). *Tsunami inundation assessment for the Gisborne District Council (Version 4)*. eCoast Limited & NIWA. www.gdc.govt.nz/assets/Civil-Defence/Tsunami-Inundation-Assessment-for-GDC.pdf

Brenkert-Smith, H., Dickinson, K.L., Champ, P.A., & Flores, N. (2013). Social amplification of wildfire risk: The role of social interactions and information sources. *Risk Analysis, 33*(5), 800–817. doi: 10.1111/j.1539-6924.2012.01917.x

Bucchi, M., & Trench, B. (2008). *Handbook of public communication of science and technology*. Routledge.

Cadag, J. R. D., & Gaillard, J. C. (2012). Integrating knowledge and actions in disaster risk reduction: The contribution of participatory mapping. *Area, 44*(1), 100–109. doi: 10.1111/j.1475-4762.2011.01065.x

Couling, M. (2014). Tsunami risk perception and preparedness on the east coast of New Zealand during the 2009 Samoan Tsunami warning. *Natural Hazards, 71*(1), 973–986. doi: 10.1007/s11069-013-0945-y

Design Council. (n.d.). *The design process: What is the Double Diamond?* www.designcouncil.org.uk/news-opinion/design-process-what-double-diamond

Designers Institute of New Zealand. (2018). Niho Taniwha: Communicating tsunami risk – A site-specific case study for Tūranganui-a-Kiwa. *DINZ Best Awards*. https://bestawards.co.nz/toitanga/toitanga-student/harmony-repia/niho-taniwha-communicating-tsunami-risk-a/

Dhellemmes, A., Leonard, G., & Johnston, D. (2016). *Tsunami awareness and preparedness on the East Coast of New Zealand's North Island*. GNS Science. http://shop.gns.cri.nz/sr_2016-020-pdf

East Coast LAB. (n.d.). *East Coast and Hikurangi Plate Boundary*. www.eastcoastlab.org.nz/discover/learn/east-coast-and-hikurangi-plate-boundary/

Fleming, J., Longnecker, N., Salmon, R. A., & Hikuroa, D. C. H. (2020). Participatory science and bicultural knowledge communication. In T. Gascoigne, B. Schiele, J. Leach, M. Reidlinger, B. V. Lewenstein, L. Massarani, & P. Broks (Eds.), *Communicating science: A global perspective* (pp. 71-102). ANU Press. doi: 10.22459/CS.2020

Giacomin, J. (2014). What is Human Centred Design? *The Design Journal, 17*(4), 606–623. doi: 10.2752/175630614X14056185480186

Gisborne District Council. (n.d.). *Tsunami inundation and evacuation maps*. www.gdc.govt.nz/tsunami-evacuation-maps/#Advice

Goodall, L. (2016, February 26). What is Mātauranga Māori? *Sciblogs*. https://sciblogs.co.nz/matau-taiao/2016/02/26/what-is-matauranga-maori/

Hikuroa, D. (2017). Mātauranga Māori—The ūkaipō of knowledge in New Zealand. *Journal of the Royal Society of New Zealand, 47*(1), 5–10. doi: 10.1080/03036758.2016.1252407

Hudson, M., Roberts, M., Smith, L., Tiakiwai, S.-J., & Hemi, M. (2012). The art of dialogue with indigenous communities in the new biotechnology world. *New Genetics and Society, 31*(1), 11–24. doi: 10.1080/14636778.2011.597979

IDEO. (n.d.). *Design Kit: How Might We.* www.designkit.org/methods/3

IDEO. (2015). *The field guide to human-centered design: Design kit*. www.designkit.org/resources/1

Janice, C., Burns, M. A., Dagmar, P. P., & Paz, S. R. (2012). *Participatory asset mapping*. Advancement Project. www.communityscience.com/knowledge4equity/AssetMappingToolkit.pdf

Kilgour, J. (2014). *Tikanga*. Science Learning Hub. www.sciencelearn.org.nz/resources/450-tikanga

King, D., & Goff, J. (2010). Benefitting from differences in knowledge, practice and belief: Māori oral traditions and natural hazards science. *Natural Hazards and Earth System Sciences, 10*, 1927-1940. doi: 10.5194/nhess-10-1927-2010

King, D., Goff, J., & Skipper, A. (2007). Māori environmental knowledge and natural hazards in Aotearoa/New Zealand. *Journal of the Royal Society of New Zealand, 37*(2), 59–73. doi: 10.1080/03014220709510536

Le De, L., Gaillard, J. C., & Friesen, W. (2015). Academics doing participatory disaster research: How participatory is it? *Environmental Hazards, 14*(1), 1–15. doi: 10.1080/17477891.2014.957636

Lee, J. N. M. (2009). Decolonising Māori narratives: Pūrākau as a method. *MAI Review, 4*(2), 1-12. www.review.mai.ac.nz/mrindex/MR/article/view/242.html

Mahuika, N. (2019). A brief history of whakapapa: Māori approaches to genealogy. *Genealogy, 3*(2), 1-13. doi: 10.3390/genealogy3020032

Martin, B., & Hanington, B. M. (2012). *Universal methods of design: 100 ways to research complex problems, develop innovative ideas, and design effective solutions*. Rockport Publishers.

McFadgen, B. (2007). *Hostile shores: Catastrophic events in prehistoric New Zealand and their impact on Māori coastal communities*. Auckland University Press.

Mercer, J., Kelman, I., Taranis, L., & Suchet-Pearson, S. (2010). Framework for integrating indigenous and scientific knowledge for disaster risk reduction. *Disasters, 34*(1), 214–239. doi: 10.1111/j.1467-7717.2009.01126.x

National Emergency Management Agency. (n.d.). *Get tsunami ready*. www.civildefence.govt.nz/get-ready/get-tsunami-ready/

Open Design kit. (n.d.). *Personas*. http://opendesignkit.org/methods/personas/

Peters, M. (2018, October 4). Earth energy wins gold for design. *The Gisborne Herald*. http://gisborneherald.co.nz/entertainment/3668859-135/earth-energy-wins-gold-for-design

Pihama, L., Southey, K., & Tiakiwai, S. (Eds). (2015), *Kaupapa rangahau: A reader. A collection of readings from the Kaupapa Rangahau workshops series* (2nd ed.). Te Kotahi Research Institute.

Power, W., Horspool, N., Wang, X., & Mueller, C. (2016). *Probabilistic mapping of tsunami hazard and risk for Gisborne City and Wainui Beach*. GNS Science. www.gdc.govt.nz/assets/Files/Planning-Policy/Probabilistic-Mapping-of-Tsunami-Hazard-and-Risk-GNS-Report-2015-.pdf

Power, W., Kaneko, Y., Becker, J., Lin, S., Holden, C., & Mueller, C. (2018). *Hikurangi Response Plan: Developing a scenario for an Mw 8.9 Hikurangi earthquake, including tsunami modelling and a preliminary description of impacts*. GNS Science. www.eastcoastlab.org.nz/assets/Uploads/CR2018-168-Hikurangi-Response-Plan-4.pdf

Rogers, A., Castree, N., & Kitchin, R. (2013). Situated knowledge. In *A dictionary of human geography*. Oxford University Press. www.oxfordreference.com/view/10.1093/acref/9780199599868.001.0001/acref-9780199599868-e-1686

Royal, T. (2006). Tangaroa – the sea. In *Te Ara - the encyclopedia of New Zealand*. Manatū Taonga Ministry for Culture and Heritage. www.teara.govt.nz/en/tangaroa-the-sea/print

Sanders, E. B.-N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign, 4*(1), 5–18. doi: 10.1080/15710880701875068

Smith, L. T. (2012). *Decolonizing methodologies: Research and indigenous peoples*. Zed Books.

Taonui, R. (2005). Tribal organisation. In *Te Ara - the encyclopedia of New Zealand*. Manatū Taonga Ministry for Culture and Heritage. https://teara.govt.nz/en/tribal-organisation

Taumaunu, H. M. (2001). *WAI272 Affidavit of Hone Meihana Taumaunu in the matter of Waitangi Act 1975: A claim by Apirana Tuehae Mahuika for and on behalf of Te Runanga o Ngati Porou.* New Zealand Parliament Pāremata Aotearoa. www.parliament.nz/resource/0000163291

Te Ipukarea. (n.d.a). Iwi. In *Māori dictionary*. Retrieved March 13, 2018, from https://maoridictionary.co.nz/search?idiom=&phrase=&proverb=&loan=&histLoanWords=&keywords=iwi

Te Ipukarea. (n.d.b). Mana. In *Māori dictionary*. Retrieved March 13, 2018, from https://maoridictionary.co.nz/search?idiom=&phrase=&proverb=&loan=&histLoanWords=&keywords=mana

Te Ipukarea. (n.d.c). Taniwha. In *Māori dictionary*. Retrieved March 13, 2018, from https://maoridictionary.co.nz/search?idiom=&phrase=&proverb=&loan=&histLoanWords=&keywords=taniwha

Te Ipukarea. (n.d.d). Taonga. In *Māori dictionary*. Retrieved December 14, 2020, from https://maoridictionary.co.nz/search?idiom=&phrase=&proverb=&loan=&histLoanWords=&keywords=taonga

Te Ipukarea. (n.d.e). Tūrangawaewae. In Māori dictionary. Retrieved March 13, 2018, from https://maoridictionary.co.nz/search?idiom=&phrase=&proverb=&loan=&histLoanWords=&keywords=turangawaewae

Te Rau Matatini [Te Rau Ora Webinars]. (2017, August 13). *Tikanga Rangahau Webinar Series: Kaupapa Māori Methodology* [Video]. YouTube. www.youtube.com/watch?v=w3aSsvLFsT4&ab_channel=TeRauOraWebinars

Tūpara, N. (2005) Tūranganui-a-Kiwa tribes. In *Te Ara - the encyclopedia of New Zealand*. Manatū Taonga Ministry for Culture and Heritage. www.TeAra.govt.nz/en/turanganui-a-kiwa-tribes

Wilson, S. (2008). *Research is ceremony: Indigenous research methods*. Fernwood Publishing.

Witehira, J., & Trapani, P. (2015). The Whakarare Typeface Project: When culture-specific visual design brings elements of universal value. In *The Virtuous Circle Cumulus Conference* (pp. 414-442). International Association of Universities and Colleges of Art, Design and Media.