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How to communicate risk when it feels like no one is listening

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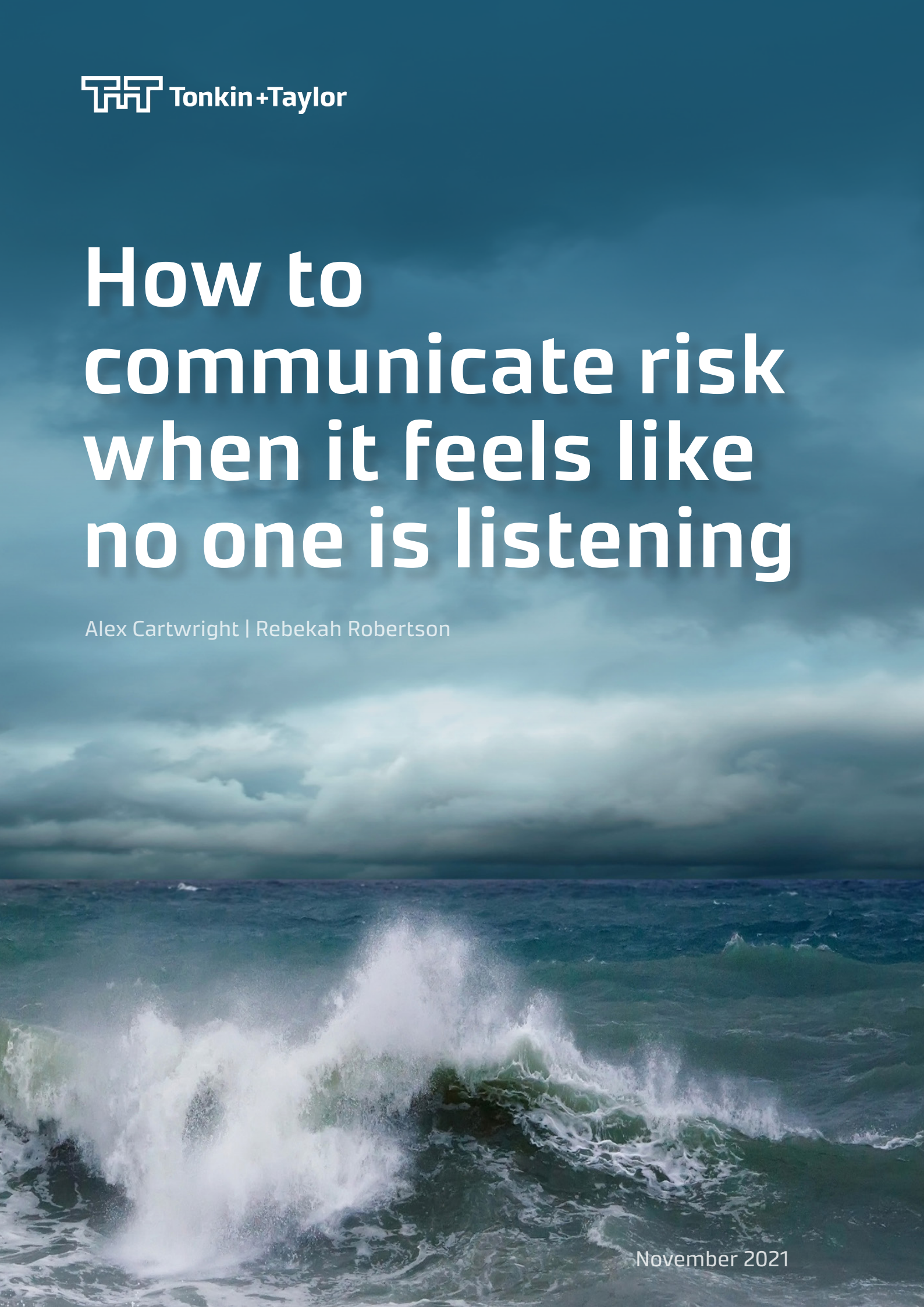

November 2021

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Cartwright, A., + Robertson, R. (2021) How to communicate risk when noone is listening. IPWEA Conference Paper 2021.

Key words

- Risk
- Communication
- Climate Change
- Natural Hazard Risk
- Risk Perception

Abstract

As our understanding of natural hazards and climate risk improves, how do we enable individual decision makers to be best informed? Our paper will focus on the communication of risk information, and how the psychology of individuals controls the success. Through looking at existing research to understand the differing ways we perceive and communicate risk, our paper highlights the requirement to ensure more effective public risk information and enable effective decision making within our communities.

We focus on two key aspects that inform an individual's response to risk, the cognitive and emotional dimensions, which refer to how much people know and understand about risk, and how someone feels about risk. Our paper will capture the psychological responses when informed about risk and look to establish principles for risk communication for differing individuals and communities. Concepts such as 'probability neglect' further impact risk information and decision making of the public, demonstrating the need for our industry to better communicate risk to enable effective decision making.

Introduction

Public perception, understanding and values are core drivers of the decisions and actions we take in our collective industries (Granger Morgan, 1997). What the public knows, and thinks are fundamental factors when measuring success of public works, including changes to infrastructure, systems, and processes. With technology breaking down the divide between decision makers and the public, the need for alignment in perception, understanding and values is critical. The health sector has already identified the need for research to go beyond public engagement and toward true partnerships with those affected.

A quote from a West African social scientist depicts the ever-present issue we are seeing across decision making, "*when you don't see the problem the same way, you can't craft solutions together*" (Wright, et al., 2020).

Misalignment in public perception, understanding and values with those of regulatory agencies is well documented. A study carried out thirty years ago by the U.S. Environmental Protection Agency (EPA) asked "are we paying attention to the right set of environmental risks?".

The results showed that the American public ranked the most pressing risks differently to those of the regulatory body. The EPA response was that "the general public simply does not have the information" (Stevens, 1991). Thirty years later, in an ever more connected world, we are still witnessing this misalignment between public and practitioners, impacting not only the potential success of public works, but ultimately the health, safety and wellbeing of our collective communities.

Climate change continues to exacerbate hazards for our communities, with public works focused around improving resilience primarily through technical excellence. Without buy-in from the community the benefits of risk management are not fully optimised, and in some cases are unachieved. The methods that we, as an industry, use to define risk play a vital part in the way that we engage with the public, and contribute to notions that practitioners and the public do not see problems in the same way. Focusing on natural hazard and climate change risk, this paper explores the potential causes of this misalignment, highlights better methods to communicate risk, enabling a shift toward true partnerships.

Defining risk

The way that we choose to define risk provides the structure and framing of subsequent assessments and communication. As an industry we define, assess and communicate risk in many different ways, including differing approaches by the International Organization for Standardization (ISO), the United Nations Office for Disaster Risk Reduction (UNDRR), and the Intergovernmental Panel on Climate Change (IPCC) (Table 1).

While this paper does not seek to define risk, the differing approaches used by recognised organisations leads to confusion within industry (Table 1) and adds complexity for the public. Table 1 also shows that individual organisations have updated their definition of risk over time, reflecting learnings within industry, however do these updates reflect the understanding of the general public? When searching online for the definition of risk, the first result is Wikipedia (n.d.), stating

"*in simple terms, risk is the possibility of something bad happening*".

This definition helps focus in on what the public seek from risk communication.

Table 1: *How differing Organisations define and assess risk*

Organisation	Definition	Assess
ISO 31000 (2018)	"the effect of uncertainty on objectives"	Probability (likelihood) x consequences
UNDRR (2017)	"the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity"	Hazard x Exposure + Vulnerability
IPCC (2014)	"the potential for consequences where something of value is at stake and where the outcome is uncertain, recognising the diversity of values"	Interaction of vulnerability, exposure, and hazard, where vulnerability is determined by assessing sensitivity and adaptive capacity
IPCC (2021)	"the potential to adverse consequences"	Hazard, exposure, vulnerability, consequence

Communicating hazard and risk information

Given the various definitions mentioned in Table 1, the way that risks from natural hazards are communicated also ranges. Focus is primarily given to quantifying hazard likelihood, through differing approaches including Annual Exceedance Probability (AEP), an Average Recurrence Interval (ARI) and alert or warning levels. The AEP refers to the probability of a certain intensity of a hazard occurring in a single year. The ARI describes the average period of time between events of a given magnitude and is often referred to as a return period such as a 1 in 100 year event (Auckland Council & GNS Science, 2014).

For the public, return periods are the most common way that natural hazard events and associated risk are discussed and expressed. This approach often leads to confusion, misunderstanding, and misalignment between the information received and the decisions that are made. The way that information around likelihood, or possibility, is represented strongly impacts the ability for the public to make effective decisions. Using floods as an example, a prospective homeowner presented with a property that is in a flood prone area may make differing decisions, based on how information is presented to them (Grounds, et al., 2018).

When informed that the property could flood during a 1 in 100 year event (or the 1% AEP), the potential homeowner may ascertain that the event could occur once in the next 100 years. By changing the way we communicate this likelihood and making it more relevant to the potential homeowner, the picture is much different. The presumed 1% possibility of a flood impacting the home in a given year, becomes a 26% possibility during the average length of a mortgage (30 years), and a 66% possibility during the next 100 years. When shown as an image, suddenly that 1 in 100 year event becomes much more present (**Figure 1**).

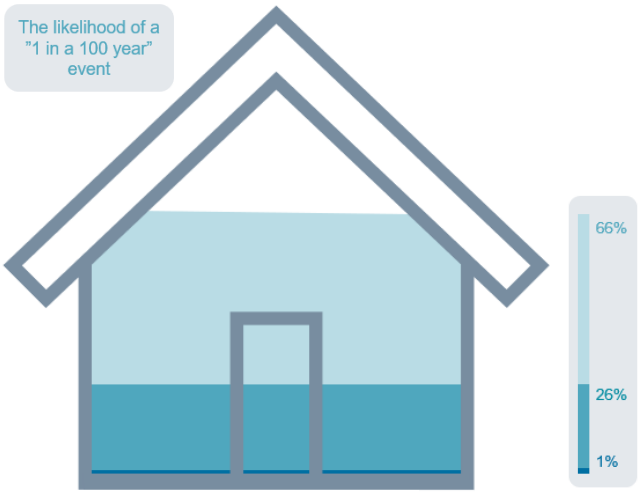

Figure 1:
Depiction of the liklihood of a 1 in 100 year flood event over 1, 30 and 100 years.

Beyond the initial misunderstanding of likelihood, the focus on return periods (and likelihood more generally) is based on historic information. Climate change is resulting in more frequent and higher intensity extreme weather events (Seneviratne et al., 2012, Ministry for the Environment, 2018), resulting in return periods being less reflective with each day that passes beyond the assessment period. Research by prominent coastal scientist Rob Bell has suggested this for coastal flooding, with what has traditionally been classified as a 1 in 100-year event will likely occur nearer to the 1 in 20 year event (Stuff, 2018).

Alert or warning levels have also been used to communicate information associated with hazard and risk to the public. The effectiveness of alert levels was seen during New Zealand's response to COVID-19, with clear and effective messaging tied to alert levels keeping the public informed, and in the most part compliant (Stuff, 2021). For weather events, the recently introduced (2019) Met Service weather warnings enable communication to the public for when forecasted weather (such as windspeed, rainfall, snowfall elevation or wave height) meet specified criteria or thresholds of intensity. During the May 2021 Canterbury floods the Met Service, in conjunction with the Regional Council flood specialists issued a Red Weather Warning ahead of the event, only the second time this has been issued in New Zealand. This approach translates technical information into more concise and consistent categories, with the aim to help the public be more informed.

Around the world there is still a clear disconnect between the forecast and warning information provided and the understanding of the potential impacts by those who received the warning.

Even with increasing confidence in the forecasting of hazards, particularly hydrometeorological hazards, these events continue to result in death, injury and damage to infrastructure, with additional adverse consequences (WMO, 2015; Weyrich, et al., 2018). Typhoon Yolanda / Haiyan provides one such example of this. Forecasted weather of 300+ km/hr winds and a 7+ m storm surge resulted in severe weather warnings being issued days ahead of the typhoon making landfall (Otto, et al., 2018; Lejano, et al., 2015). Despite these warnings and with the storm following the forecasted track almost directly, the impact on the Philippines in 2013 still included over 6,300 people dead and an estimated $5.8billion in damage (Otto, et al., 2018; Reid, 2018).

The World Meteorological Organisation (2015) put it simply,

'*while there is a realization of what the weather might be, there is frequently a lack of understanding of what the weather might do*'.

This reinforces the discussion above, where presenting technical information more clearly still does not always enable understanding and appropriate action by the public. The importance for the public extends beyond purchasing of property, with insurance premiums increasing, and for some withdrawal of insurance, as a result of the increasing information around hazards such as flooding. Without clear communication around risk, the consequences for the public are ever increasing.

Psychological dimensions

Recognising the differing ways of communicating technical hazard and risk information has varied levels of success, it is key to establish how individuals interpret the information provided and how the perceived risk may impact their own lives. Research has shown that risk perception has two main psychological dimensions that influence how individuals make decisions on risk information (Paek & Hove, 2017):

- The **cognitive dimension** relates to what people know and understand about the risk
- The **emotional dimension** relates to how they feel about the risk information they have received

Communicating risk is complex and requires consideration of the receiving individuals' psychology, knowledge, capabilities, and past experiences.

A common misconception when communicating risk is that individuals make decisions based only on how much they know about a given risk and associated uncertainty (Paek & Hove, 2017; Buck & Ferrer, 2012). This relates to the cognitive dimension and neglects the emotional dimension or response that will influence an individual's final decision (Buck & Ferrer, 2012). It also neglects an individual's capability to respond, such as their physical mobility and/or financial position. We therefore cannot assume that the more we educate individuals about the technical aspect of hazards, risk and uncertainty, the more appropriately they will respond. Emotions are typically considered to be irrational and are therefore excluded from risk communication and political decision making. However, emotions are necessary for understanding the impacts of the risks, particularly in relation to climate change, and they also provide key motivation for action on risk information (Roeser, 2012).

Emotional responses can be influenced by numerous variables which impact an individual's risk tolerance. Familiarity with, or past experiences of hazards generally increase a community or individual's risk tolerance (Wachinger & Renn, 2010). This was witnessed during Hurricane Katrina, where tens of thousands of people chose to remain in place, against the advice of officials, to 'ride it out like they did during Hurricane Betsy' (Lee, 2006). Dread or fear associated with the unknown (uncertainty) tends to have the opposite effect, reducing an individual's risk tolerance, resulting in a higher perceived risk. Stepping away from natural hazards, this is best illustrated when considering public perceptions of death from a car crash versus that of a shark attack. The probability of an encounter with a shark is 1 in over 3.7 million, whereas death from a car crash is 1 in 84 (Chubb, 2015). Often referred to as 'probability neglect', when strong emotions are triggered by a risk, individuals demonstrate the ability to neglect a small probability that a risk will occur.

For climate change, the longer term outlook adds another dimension to the complexity of communicating risk, with individuals and communities needing to consider beyond the present moment. Lang & Pickering (2018) describe climate change as 'The Perfect Problem' due to several psychological influences. Examples of note include people's inherent default to prioritise the present over the future and our bias to respond to threats that are personal, abrupt, immoral and are likely to occur within the immediate future (Lang & Pickering, 2018). Climate change has none of these characteristics, however perceived risks such as a shark attack tick all the required boxes. This bias overlaps with individual's response to low likelihood events, where it has been found that we are less able to make rational decisions involving low probability events (Shoemaker, 1980). Longer term outlooks and disaster events that are framed as unlikely in the present day have been shown to lead to less preparation by individuals (Crawford, et al., 2019).

The emotional dimension has a strong influence on individual's abilities to understand risk, but as practitioners our focus is primarily on the cognitive dimension. We rely on individuals already having a base understanding of the hazard or risk information, neglecting the emotional dimension. Roeser (2012) suggests that consideration of emotions is potentially the missing link to effective climate change risk communication and action by the community. If the hazard or warning information does not provide information that individuals can relate to, such as the impact/consequences, then an individual's ability to make appropriate decisions to respond to the information they have received is limited.

Applying the emotional dimension

As mentioned, when it comes to communicating or engaging with individuals or the community around natural disasters, we often revert to education about the technical aspects of risk, without appropriately considering what success looks like for community engagement and awareness. This educational focus generally focuses on the possibility (likelihood) of a hazard / risk occurring as opposed to focusing on what this means for the community or the impacts.

In terms of community engagement best practice as outlined by the International Association for Public Participation (IAP2), education falls within the 'inform' category

Figure 2: *Spectrum of Public Participation (IAP2,2018)*

INCREASING IMPACT ON THE DECISION

	INFORM	CONSULT	INVOLVE	COLLBAORATE	EMPOWER
PUBLIC PAERICIPATION GOAL	To provide the public with balances and objective information to assist them in understanding the problem, alternatives, opportunities and/ or solutions.	To obtain public feedback on analysis, alternatives and/ or decisions.	To work directly with the public throughout the process to ensure the public concerns and spirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will work together with you to formulate solutions and incorporate your advise and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

at the lowest end of the Spectrum of Public Participation (Figure 2). For risk-based planning and decision making, communities should be actively involved and contributing to decision making around risk acceptability and response options (Saunders, et al., 2013). The aim of risk communication should go beyond providing information (inform), to consulting, involving and collaborating with individuals and the community to develop ideas, and ultimately empowering them to take action (IAP2, 2018; Saunders, et al., 2013). While focus on the cognitive dimension is necessary, and achieved through education, application of the emotional dimension must be impact focused.

A "typical" flood alert

River Stour in South Warwickshire
The current level in the Shipston river gauge is 1.21 metres. River levels are rising on the River Stour, with flooding possible tonight. River levels are expected to peak between 2.9 and 3.1 metres at 2am.

Over the past 6 hours there has been 8 millimetres of rai. Further rainfall is forecast over the next 12 hours.

For a more detailed weather forecast for area, please see the Met Office website (www.metoffice.gov.uk).

An "impactful" flood alert

River Stour in South Warwickshire
Over the last 24 hours we have seen heavy rainfall in the Shipston area. This has meant that the River Stour is now rising and flooding is possible from 11pm today (Monday 5th February).

The main area of concern is around Mill Street, where forecast suggest there could be flooding to low-lying land and areas close to the river and around the bridge at the Old Mill.

No flooding of property is currently expected. Further heavy rainfall is possible overnight and this would cause river levels to rise again. This message will be updated this evening or earlier if the situation changes.

People in these areas should consider taking action now. We urge all people to take care and not to drive through flood water.

We are constantly monitoring river levels and have staff in the area checking for and clearing blockages in this location.

Impact based approach to risk communication

Research has shown that impactful content provides a way of conveying risk information to the public to enhance their decision making and empower action. Impactful information is most relatable when it is developed and delivered at a local scale, in collaboration with communities. This collaboration enables refinement of key messages that resonate with the recipients, helping individuals to make more informed decisions. This approach has been used in the UK to develop 'impactful' flood warning messages, which are aligned to existing guidance for warnings, 'but with small enhancements to introduce more impactful content' (Blazey & McCarthy, 2020). Figure 3 provides an example of a 'typical' and an 'impactful' flood alert developed by the Environment Agency in collaboration with the community for Shipston-on-Stour, England. By stepping beyond the technical information and providing more of a focus on consequences, the 'impactful' flood alert addresses both the cognitive and emotional dimensions, enabling effective messaging.

The Vanuatu National Disaster Management Office (NDMO) uses a combination of hazard information and a description of the likely impacts on land to communicate tropical cyclone categories and their associated risk, as outlined in Table 2. This presentation of the hazard information alongside impact descriptions caters to both the cognitive and emotional dimensions of decision making around risk information.

***Table 2**: Vanuatu NDMO Tropical Cyclone Categories /Hurricane winds*

Category	Wind Speed	Land Impacts
Tropical Low	Strong winds	Negligible house damage to old thatch houses and some garden crops like banana trees. Whistling heard in power and telephone wires, whole trees in motion.
Category 1	Gale force 90 – 125 km/h	Twigs break off trees. Slight structural damage occurs – roofing dislodged, larger branches break off. Garden crop damage.
Category 2	Storm force 125 – 164 km/h	Considerable 3structural damage. Trees uprooted, heavy damage to some crops. Risk of power failure.
Category 3	Destructive hurricane force winds 165 – 224 km/h	Some roof and structural damage. Some local thatch houses destroyed. Power failures likely.
Category 4	Very destructive hurricane force winds 225 – 279 km/h	Significant roofing loss and structural damage. Many Thatch houses destroyed and blown away. Dangerous airborne debris. Widespread power failures.
Category 5	Catastrophic hurricane force winds more than 280 km/h	Extremely dangerous with widespread destruction.

Conclusion

Public perception, understanding and values are core drivers of the decisions and actions we take in our collective industries. Risk is defined, assessed and communicated in many differing ways, contributing to confusion and misunderstanding with the public. Research has shown that risk perception has two main psychological dimensions that influence how individuals make decisions on risk information; the cognitive dimension and the emotional dimension. The importance of the emotional dimension when communicating risk is often overlooked, but plays a fundamental part when engaging with the public. Through prioritising the emotional dimension, risk information will be better understood by the public, enabling more informed decision making.

When looking at differing organisation's definitions of risk (Table 1) and the definition of risk put in simple terms, alignment can be seen with consequences (something bad happening, adverse consequences) and uncertainty (possibility, probability, likelihood). Through defining risk as "consequences and their associated uncertainties", the emotional dimension is presented first, promoting its importance through assessment and communication.

By enhancing our connections with the public, practitioners can deliver better outcomes for our collective communities, and craft solutions together. Impact based warnings have shown the value of collaborating with the public, stepping beyond the technical information and providing more of a focus on consequences, addressing both the cognitive and emotional dimensions, and ultimately enabling more effective messaging and uptake for the community.

Acknowledgements

The authors would like to acknowledge the IPWEA panel for recognising the value of this paper topic, and colleagues at Tonkin + Taylor for the ongoing support and guidance.

This paper was originally published for ACE New Zealand and IPWEA NZ Future-Fit Aotearoa Conference and Awards 2021.

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Alex is passionate about better integrating people and the environment. He focuses on developing knowledge and preparedness for floods and other natural hazards. Having lived within a community that flooded, Alex acutely understands the disruption that incidents have, helping him communicate with individuals who have, or could, experience disaster.

Alex was the lead author of the Built Environment chapter of NZ's first National Climate Change Risk Assessment (NCCRA).

With a background in risk reduction and emergency management, Alex has been deployed into a variety of events, including operational & strategic flood response roles in the UK and NZ, and the National Crisis Management Centre to support NZ's response to the Covid-19 pandemic. Alex co-authored a paper on operational plans to aid incident management, published by the Institution of Civil Engineers.

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Rebekah is driven by making an impact on the world through preparing for and effectively responding to natural disasters and climate change. Rebekah works across various levels of council, government and private organisations throughout New Zealand, Pacific and Asia to help reduce disaster risk and build resilience from the community up through sustainable development.

Rebekah has played an integral role in developing Tonkin + Taylor's expertise in the International Development and Humanitarian Space throughout Asia and the Pacific.

This has included the development of impact based early warning systems and carrying out climate change and natural hazard risk assessments.