RISK AND RESILIENCE REPORT 10

Public interpretation of risk information: decisions and action

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Purpose: The Swiss Federal Office for Civil Protection (FOCP) has tasked the Center for Security Studies (CSS) at ETH Zurich with compiling factsheets on Critical Infrastructure Protection and on risk analysis to promote discussion and provide information about new trends and insights.

Contents

1 Introduction

This report explores the relationship between risk communication and public decision making regarding risk. This topic is of central interest to risk communicators given that the gap between risk messages and public behaviour is widely recognised, but nevertheless remains difficult to manage. Effectively communicating risk mitigation and hazard adaptation strategies to the at-risk public is a fundamental goal and role of risk management organisations globally. Appreciating why formal risk messages do not always result in the intended risk protective behaviour is therefore as important to the risk communicator as technical knowledge about risk, its probability of occurrence, and the consequences for society.

This report builds on existing reports that have explored aspects of risk communication methodologies: 'Visualising Risk' (Risk Focus Report 9); 'Using the Internet for Risk Communication' (Risk Focus Report 8); 'The Changing Dynamics of Crisis Communication: Evidence from the Aftermath of the 2011 Tsunami in Japan' (Risk Fact Sheet 6). In particular, the report extends the discussion about targeting risk information (Risk Fact Sheet 9: Using [the right] media to reach the audience: Best practices of media use in public risk communication) by specifically exploring the deeper reasons (social, psychological, economic and environmental) behind people's difficulty in converting risk information into risk-mitigating behaviour.

In section 2 we provide a brief background to the discussion about the relationship between risk communication and decision making. Section 3 then briefly explores why risk communication is important, focussing on its influence over preparedness and the relationships between vulnerability and resilience. Section 4 explores some general characteristics of the individual and risk communication method that influence public interpretation of risk messages. Lastly, we discuss how some of the challenges presented in section 4 might be present in Switzerland, and how Swiss risk communicators at both the Federal and Cantonal levels might address some of these challenges.[1]

2 Background: risk communication and public decision making

Hazards are characterised by interactions between technical, natural and social systems, with the interface between them having the potential to be harmful to people, property and the environment – they pose known risks to our society. This potential distinguishes the hazard from a disaster, which presents the reality of that potential or threat, and the losses and disruption associated with it.[1] As such, the hazard is the cause of a disaster, and in many cases this cause is uncontrollable. For example, Swiss living in areas of high flood risk have little control over the occurrence of a flood during early spring when mountain snow begins to melt. However, while the cause of the flood may not be controlled by the individual, the consequences of the flood often can be, and distinguishing uncontrollable cause from controllable consequences has become a key component in effective risk communication. Of course, some consequences of hazards can be avoided in the first place if they are known, and can be mitigated – especially by effective communication about hazard risk by a risk management agency.

A large and growing body of evidence suggests that those people who receive risk information do not automatically act on it. While risk information is directed at members of the public known to be at risk (and assumed to be cognisant of that risk), many individual, community and institutional level factors contribute to the incorporation of this information into an individual's frame of reference. For example, most people in Switzerland have some awareness about flooding threat (whether or not they live in risky areas). In many cases this awareness may extend only to a basic level, comprising some knowledge about the hazard itself and about how or where the hazard effects might occur, but less about how those effects might create consequences that can be avoided through active mitigation.[2, 3] People with minimal knowledge or a basic awareness about flooding (or any other risk) are not necessarily cognisant of risk, and therefore have less ability to place their own circumstances into a risk context that enables them to make meaning out of risk information, which permits or induces the intended actions advocated in risk messages.[2, 4]

Even people who do have sufficient knowledge about the consequences of risk, which might allow them to make sense of those consequences and act to mitigate them, do not necessarily do so.[5, 6] While the individuals might find the risk information important enough to do something about it, they may also consider that other things in their lives require more urgent attention,

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1 Much of the research reported in this focal report pertains to risk associated with natural hazards. Where research has focussed on other forms of hazards (like socio-technical hazard for instance), this association is specifically noted.

especially if the risk is unpredictable or unforeseeable – for example the '100-year flood'.[3, 7, 8] So, while risk communicators pass information with the intention of influencing the behaviour of an at-risk public, their efforts are not always rewarded as anticipated.

For the agencies or organisations who produce and present risk information, communicating the need to prepare is straightforward and obvious,[9–11] but this is not necessarily the case for the public. While risk communicators completely understand the necessity for risk communication because their business is to know risk thoroughly, the public rarely shares such objective knowledge or beliefs about risk.[12, 13] A consequence of this is a poor translation of risk communication into behaviour change and greater public preparedness levels.[5, 14, 15]

Natural hazard activity and the risk it poses to our society is probabilistic by nature.[12, 16, 17] Some natural hazards are rare (earthquakes or tsunamis), others are seasonal (bushfire or floods), most are partly or wholly unpredictable. Certainly, there exists no fail-safe ability or mechanism to successfully predict when natural hazards will occur, where they might occur, what intensity or consequences they may have, or how long their activity will last. However, all natural hazards can be attributed some value of likelihood.

Importantly, the traditionally communicated probabilistic nature of natural hazards (*i.e.* the likelihood of occurrence), and socio-technical hazards to a lesser degree, has tended to contribute to public ignorance of the possibility of activity, or the attribution of low priority.[13, 16, 18] As a consequence, in many cases reporting of hazard likelihood by risk management agencies often reduces the public's predisposition to mitigate the consequences of hazard activity. Householders may also ignore information concerning the likelihood of hazards because they feel that they have no influence over probabilistic messages.[12, 16] By contrast, because the individual can influence the consequences of a natural hazard (*e.g.* by being well-prepared), it is much easier to consider and evaluate the manageability of those consequences.

Official risk communication can be considered an effective substitute where knowledge about risk and consequence may usually be obtained through experience (which is important given the infrequent nature of events), familiarity or social/familial connections. Risk communication can also provide the public with a formal source of comprehensive information that can complement their other information sources. The process of communicating to the public about risk then becomes a mechanism aimed at generating the appropriate understanding, risk acceptance and risk response (*e.g.*, mitigation, preparedness).[5, 19]

3 Why is risk communication important?

Risk communication is considered a fundamental component of a holistic risk management approach. By providing objective information about risk through risk communication processes, risk managers aim to encourage at-risk individuals to undertake 'protective behaviours' that are known to mitigate risk. Protective behaviours typically entail preparation actions – which may be undertaken at the individual level, at the level of the household, within an at-risk community, or through collaboration between risk management agencies and the public. 'Being prepared' is commonly advocated because effective preparation is known to increase societal resilience to hazard, and decrease societal hazard vulnerability. The relationships between risk communication preparedness, resilience and vulnerability are briefly discussed here.

3.1 Preparedness

Preparation is important because it encompasses a wide variety of protective behaviours that experience and research has demonstrated can contribute to reduced vulnerability and increased resilience to a broad variety of hazards.[20] However, the key benefit that preparation brings to the individual, whatever the hazard, is the ability of such action to mitigate the consequences of hazard activity. Minimising the consequences of a hazard through effective preparation can contribute significantly to reducing the ultimate effects of hazard activity, and increasing the ability to cope with and adapt to hazard consequences. Both objectives – reducing vulnerability and increasing resilience – can be achieved by promoting hazard preparedness, and this has become the fundamental goal of risk communication.

3.2 Resilience and vulnerability[2]

One of the key goals of contemporary natural hazard risk management is the development of a resilient society. Paton, Smith and Violanti suggest that resilience is an "active process of self-righting, learned resourcefulness and growth"[21, p.173] that allows individuals to effectively and safely deal with situations (like the consequences of

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2   For more detailed explorations of resilience and vulnerability, see: Prior T, Hagmann J. Measuring Resilience: Benefits and Limitations of Resilience Indices. SKI Focal Report 8, Center for Security Studies: ETH Zürich, 2012; Hagmann J. Risiko, Verwundbarkeit, Resilienz: Neue Gefahrenkonzepte in der internationalen Sicherheitsanalyse. Risk Analysis Factsheet 7, Center for Security Studies ETH Zurich, Switzerland, 2012; Bara C, Brönnimann G. Resilience – Trends in Policy and Research. Risk Analysis Focal Report 6, Center for Security Studies (CSS), ETH Zürich, 2011.

natural hazard activity) that are outside of their normal experiences. The resilience of individuals can be a function of their vulnerability,[14] or susceptibility to an adverse effect, which may be heightened by a wide variety of factors (socio-economic status, age, ethnicity, gender *etc*). However, resilience and vulnerability need not be inter-dependent – building resilience does not automatically reduce vulnerability, and addressing vulnerability does not necessarily increase the resilience of an entity.
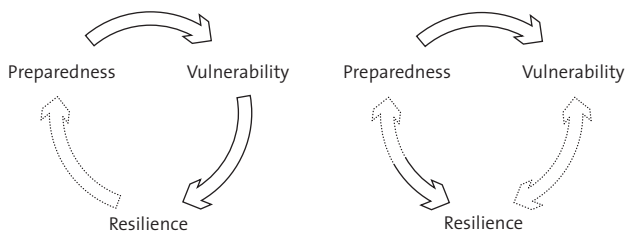

Figure 1: The 'relationship' between preparation, vulnerability and resilience.

Figure 1 illustrates two variations on the way resilience and vulnerability might be related to preparedness. In the top figure, preparedness directly reduces vulnerability, which in turn directly increases resilience. But the relationship between resilience and preparedness is less clear. In the lower figure, this lack of clarity is embraced: while preparedness still reduces vulnerability, it may also increase resilience directly. The relationships between resilience and vulnerability are unclear, but each has some influence over the other. Also, whether or not resilience influences preparedness is an open question.

In order to reduce vulnerability among those members of a society deemed to be at risk, risk management techniques must be effective and delivered efficiently in a timely and appropriate manner. Risk communication can be used by specialised emergency management agencies to deliver a 'targeted' message about risk, but also provides a means of exchanging information aimed at informing or influencing public decision-making.[22]

Typically, information about risk is targeted at those members of society who are deemed to be at risk. Risk communicators target their information at an audience they feel most requires that information, a process informed by the organisation's experience, technical knowledge of the risk or hazard behaviour, and knowledge of the public's capacity to deal with that risk. By promoting preparedness, risk communicators aim to vicariously influence both the target entity's resilience and vulnerability (preferably increasing resilience, while reducing vulnerability, though it must be emphasised that these 'states' are most often not interdependent).

4 Factors influencing risk interpretation and behaviour

Many factors influence the public's interpretation of risk information. Often these factors are associated with the uncertainty of a hazard actually occurring, and the complex and unpredictable consequences that may result from the hazard's activity. As such, promoting preparedness is not a straightforward task, where communication of risk-relevant information results in a one-to-one transfer in public behaviour.

Paul Slovic[13, p.403] identified that the primary difficulty in risk communication is overcoming "the idiosyncrasies of the human mind" and "finding comprehensible ways of presenting complex technical material that is clouded by uncertainty, and is inherently difficult to understand". To be effective in a hazard risk and preparedness context, risk communicators must identify mechanisms that translate expert information and knowledge into messages or education materials that marry technical risk analysis with subjective individual thinking about risk. This means engaging an audience, who may not be receptive, with information that they find meaningful and understandable.[23]

Where a threat is rare and complex, when personal relevance of the threat is low, when threat is unpredictable,[7, 8, 24] or where people do not perceive a risk as being salient in their daily life,[15, 25] individuals are less likely to attend to, recognise the importance of, or act on risk communication information (this issue is explored more in Box 1 in the context of risk associated with crossing the road).³ Each of these cases holds true for many natural and technical hazards. In addition, rarity, complexity, unpredictability, low personal relevance and salience all negatively influence the public's often pervasive inability to distinguish the controllable consequences of natural and technical hazards from their uncontrollable causes. These features ultimately contribute to a choice not to

Box 1: Building risk tolerance through experience.
Most people from developed countries would not consciously think about the risk associated with a simple road crossing. The same people might develop a disproportionate fear of a plane crash, tsunami or shark attack, even though the likelihood of these risks is several orders or magnitudes lower. Our familiarity with crossing the road allows us to subconsciously diminish the consequences of this risk; one that killed 75 Swiss people and severely injured 691 in 2012.

3   http://www.bfs.admin.ch/bfs/portal/de/index/themen/11/06/blank/01/aktuel.html

actively mitigate risk from hazards, instead taking a fatalistic attitude to the threat,[26] and hoping particularly that low probability means never.

As mentioned, there are many reasons why people do not act on hazard-specific risk communication information. Here we explore some of the general factors, including the social construction of risk; individuals' mental models of risk; conflicting lifestyles or lifestyle choices; demographic characteristics; the risk communication technique used; and lastly, the unpredictability and uncertainty of hazards. Following the discussion of these issues we highlight several of the most important points that should help to inform risk communication processes in Switzerland (section 4).

4.1 Social construction of risk and risk perception

The concept of risk from natural hazards describes the assessment of the frequency of occurrence and consequences (*e.g.*, nature, magnitude, duration, *etc*) associated with hazard activity. This definition implies a purely technical concept, which is suited to institutional use (because it informs the development of risk messages), but does not inform the meaning of risk from the perspective of the layperson. The focus on risk in a purely probabilistic context, as has been the traditional practice of many hazard management agencies when communicating about risk, has overlooked the fact that individuals who receive risk information construct their idea of risk in a very different way, yielding different conceptions. The social construction of risk ensures many community members view well-known risks in ways that often oppose those concepts held by risk management agencies.[27, 28] People interpret risk information in the context of their past experiences, their beliefs and their relationships with others (*e.g.* family, friends or other community members).

Studies of the perception of risk have largely informed the development of risk communication. Risk perception involves a process where individuals "subjectively or intuitively comprehend, estimate and evaluate the probabilities and consequences of risks".[29, p.175] Risk perception research has followed in two primary veins: psychometric examinations of the way individuals consider risk; and explorations of risk perception based on social and cultural influence. The former, termed psychometric theory has concentrated on developing an understanding of how an individual views risk and is based largely on several explanatory measurement scales that characterise risk.

While popular, the psychometric model of risk perception has its detractors (who suggest its ability to describe risk perception might be a function of the overlap between the psychometric measurement scales used). By contrast, considering risk perception from a cultural point of view, termed 'cultural theory', provides an alternative descriptive tool. Cultural theory specifies four types of people (egalitarian, individualist, hierachist and fatalist) who respond differently to risk based on their social context and how this might govern their beliefs about those risks. Cultural theory highlights that the individual's social, cultural and political ties influence the way they think about and act on risks.[30−3] However, the proposition that this response may be determined by a person type has received mixed empirical support.[18, 34]

Whether based on individual characteristics or socio-cultural processes, information processing about risk is affected detrimentally by biases and limitations that influence the objective evaluation of risk and risk probabilities.[17, 18, 29] A major stumbling block that research on risk perception has identified for risk communication is the overwhelming demonstration that individuals (be they expert or lay-people) perceive risk differently because of a range of interdependent 'bio-ecological'[35] or 'socio-environmental' factors like their different psychological, socio-cultural or experiential backgrounds.

These 'socio-environmental' factors influence the individual's social construction of risk, which in turn influences their capacity or predisposition to recognise and respond to the risky characteristics in the environment where they live. Many authors have identified that this influence can often preclude an effective response to the risky characteristics of the environment.[5, 36−38] As a part of this environment, the social networks within which people associate can have dramatic influences on the perceptions of their environment.[32, 39] The nature of the social network could have positive or negative impacts on risk perception and protective behaviour. Some networks, which might develop in response to a specific hazard, can help people to distinguish, respond to and mitigate hazard risk. In these networks or community groups the hazard can become a culturally relevant and important part of the members' lives – they are established around knowledge sharing and awareness about the hazard because the members value these information assets very highly, and will use these assets to help translate their new-found knowledge into mitigation action. By contrast, people whose social networks or social influences are not hazard-orientated are unlikely to seek to develop ideas of specific hazard awareness, and this is true in many risk-related phenomena.

Importantly, just living in an area known to be a hazard risk location is typically not sufficient to engender a risk averse attitude to that environment, risk acceptance, or the adoption of protective behaviours designed to mitigate that risk. Research exploring the social construction of risk illustrates that decisions about interpreting risk and how to address it, are not made in isolation, but with respected or significant others (particularly

when the issues are complex, uncertain or rare).[39, 40] Individuals with less knowledge or experience of risk rely on family, friends or neighbours to help them interpret the risk presented by the environment where they live. Consequently, the social construction of risk becomes an extremely important consideration for risk management agencies. Without specifically contemplating the social construction of risk, the objective of increasing community preparedness may be consistently frustrated.

Members of society or societal institutions each bring their own interpretative processes to bear on the task of understanding and reacting to risk. Hazards are dealt with in a socially constructed fashion,[41] where hazard risk is considered in light of culture, knowledge, beliefs and experiences. Although there is always an objective level of risk associated with a hazard, public perception of that risk may be clouded by social and cultural processes. Risk management agencies often find it difficult to reconcile their objective assessments of risk with the socially constructed understandings of the community members for whom they target risk information. Unsurprisingly, many risk communication efforts fail to engender their intended result [42] – like ships in the night, the objective risk communicated by agencies sails directly past the subjective nature of the community member's risk-related beliefs.

4.2   Mental models

Researchers exploring the social construction of risk and the indirect relationship between risk perception and risk mitigation have shown that people do not receive information passively. Research illustrates that people incorporate information relevant to their lives into a 'mental model'.[22, 43–45] The mental model is an internal representation of external reality. It encapsulates the meanings that an individual constructs to predict or explain the information, experiences or other stimuli with which they interact that is developed over time from accumulated experience.[43, 44] As new information comes to hand it is interpreted and *sometimes* integrated into this mental model, which contributes to the individual's construction of reality and is used to inform his or her decisions. People are also likely to 'squeeze' new data into their existing mental models, even when that information doesn't 'fit' (contradicts other information that was used in the individual's initial construction of the model). Understanding the mechanisms that determine whether change in a mental model actually takes place is a challenging process.[22, 46] As such, mental models play an important role in how the individual interprets and responds to risk information.

Figure 2 shows how an expert constructs the risk of falling down stairs in a mental model. It shows important factors that the expert thinks might influence the likelihood of falling (oval shapes), and factors that the expert thinks might mitigate the risk of falling (rectangles). It shows that a fall must be preceded by a trip, but that factors like 'agility' and 'railing' might prevent a trip becoming an outright fall. This example is a relatively simple depiction of a mental model.

Even before first exposure to a hazard, an individual is likely to have heard and thought about the hazard (*e.g.* through friends, media etc.), and its consequences, and have therefore developed some impression of the hazard and how it might affect them (whether accurate or not). This signals the beginning of the development of their mental model. If the individuals are subsequently threatened by the hazard, they will consider their relevant options and the attendant consequences, based on this initial mental model, before making a decision or
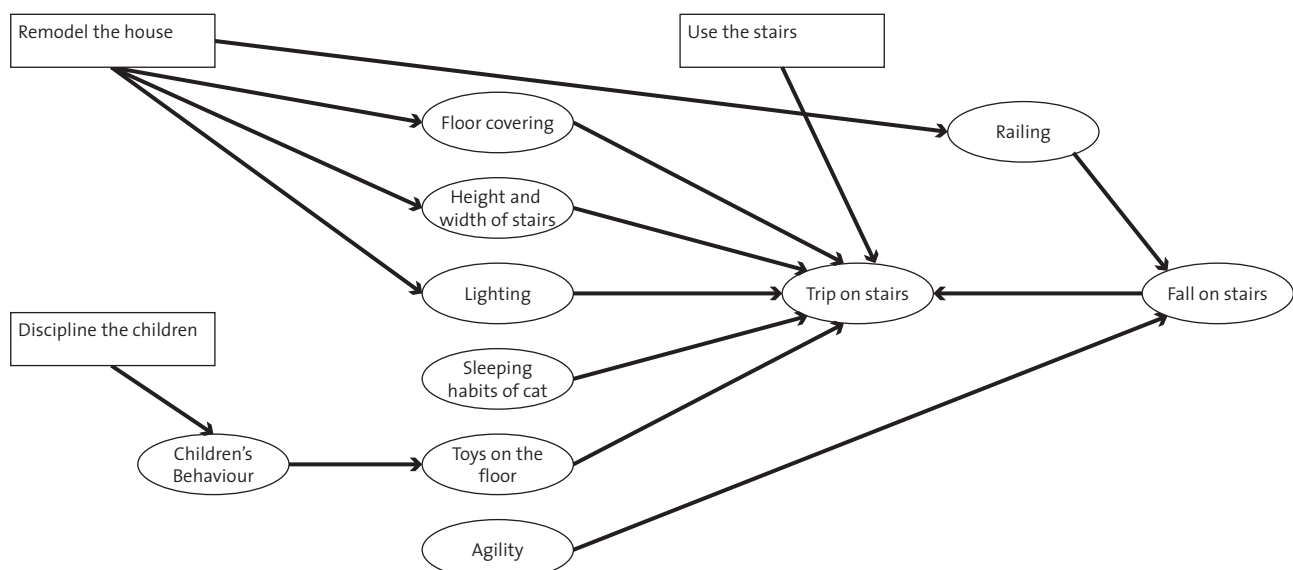

Figure 2: A representation of an expert's mental model of the risk associated with falling down stairs (From Morgan, 2002).

taking action.[44, 47] Cognitive processing in the context of this subsequent exposure is conducted within the bounds of the initial mental model, which helps the individual to speed up the decision-making process and save the decision-maker's energy and time.[22, 43, 44, 46, 47] Using mental models in this inferential fashion can permit automatic or involuntary decision-making.[47]

Cognitive psychologists theorise that mental models are developed as a result of the interaction of two systems: the cognitive analytic system and an intuitive experiential system.[48] Most researchers examining attitude and behaviour change agree that experiential knowledge is more personally relevant and more likely to influence the individual's mental model. While mental models are used to quickly represent the 'state of affairs', they are formed piece-meal, meaning the information on which they are based may not be complete from the perspective of the expert,[43, 47] although they are adequate for the individual to make decisions. Once formed, individuals are unlikely to alter their mental model unless it is challenged by new information or evidence that contradicts their current beliefs, or that can be easily incorporated into their model.

Considering the existence of a hazard-specific mental model has highlighted the danger faced by risk communicators if their communication relies on the information receiver's perception of risk as an instigator of action. As such, if risk communicators aim to develop risk messages and information that contributes to the accuracy of laypeople's knowledge about risk,[48] then effort must be directed towards understanding how the individual's mental model is formed. In addition, providing information that completes the model by "adding critical information and dispelling misconceptions" that may negatively influence decision-making is imperative.[22, p. 779] New risk information, provided through trustworthy channels, will contribute beneficially to the at-risk individual's mental model of risk and how they act to mitigate the risk's consequences.[2, 22, 46] However, risk communication that completes one person's hazard-specific mental model may not be suitable for another person. Indeed, the risk communicator must have an understanding of how the individual has constructed that model and a deep knowledge of that person's history, their culture and background, their personality and experiences – both very resource intensive propositions.

Although the value of the 'mental models approach' to risk communication development is well recognised, its practical application requires more effort than many risk communicators have historically been willing to invest.[2] However, examining hazard preparedness from a socio-cognitive perspective can yield the type of comprehensive information necessary to develop risk communication techniques and messages that engender more widespread and comprehensive hazard preparedness among at risk populations. Such research can help risk communicators to comprehend the reasons why individuals make the decisions they do (which may be counter-intuitive to expert advisers like bushfire Community Education Managers), and identify mechanisms that enable risk communicators to better influence this decision process and reach the objectives they seek.

4.3 Decision making models

While individuals use hazard-specific mental models when making decisions about risk and preparedness, the actual decision process can be considered as separate. The mental model can help an individual to 'make sense' of a situation and help them to respond in a timely manner, but many other social, environmental, technical and personal factors can influence the final decision. Exploring the way decisions are made about risks, for instance by elucidating a decision process, can be a very informative way for risk communicators to identify decision points or influencing factors that have particular importance in the final decision. Subsequent concentration on these points or factors in targeted communication is known to increase the effectiveness of risk communication information.

In order to make a decision an individual must be presented with at least two alternative choices. Each alternative poses the individual with a different set of consequences and it could be assumed that the individual applies their knowledge and reasoning ability to decide on the most rational course of action to reach the most satisfactory outcome based on their preferences. However, this is not strictly the case.[49] Individuals are active information gatherers, making decisions that reflect their situation, context and environment. Because situations and contexts (and environments to a lesser extent) are dynamic, and because people's mental models also change with experience, the same decision-making processes may not always result in the same decisions.

Classical theory examining decision-making under risk is based on expected utility,[50] and posits that an individual makes a choice after weighing the utility (cost or benefit) of each outcome against its probability of occurrence.[51] The expected utility theory has been accepted as a model of rational choice and applied widely to economic behaviour because of its ability to describe risk-averse and risk-seeking behaviours. However, a considerable body of more recent work suggests rationality is a construct of the individual.[52, 53] As identified in the previous sections, decision-making processes are far more complicated than can be represented by this classical theory – primarily because choice is a process of individual operational reasoning based on the mental model.

That individuals make decisions bounded by their own rationality, situational influences and the social construction of risk poses difficulties for those agencies producing standardised outreach material designed to encourage hazard mitigation activities (the issues associated with passive and active forms of risk communication are discussed in section 4.5). Risk managers and householders exist together on a 'rationality continuum' where rationality is perceived and acted on differently by each player. What is considered a rational choice by one person may not be viewed in the same way by the other. The result is likely to be miscommunication, misunderstanding or misinterpretation of risk communication information. [5] Because people process information quickly, based on their own situational reality (and mental model), they come to decisions that are not necessarily 'mistaken', but which simply reflect fundamentally different reasoning processes from experts. This is consistent with the view that mental models help people to assemble their knowledge of risks into a conceptual map of ideas, but also highlights the way in which laypeople's perceptions and actions concerning a risk may differ so dramatically from those the risk communicators deem appropriate.
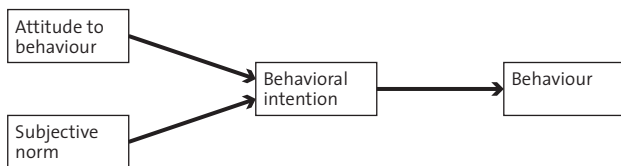

Figure 3: The theory of reasoned action. Sourced from Ajzen and Fishbein (1980).

In the 1970s and 1980s socio-cognitive psychologists began to model decision making in relation to risk. One of the earliest models was the 'theory of reasoned action' (see Figure 3), which first highlighted that behavioural intention was a precursor to actual behaviour. [54] This was built on in the development of the 'theory of planned behaviour' (Figure 4), which improved the ability of the theory of reasoned action to predict behaviour by incorporating individual beliefs in the model. [55, 56] While simple,

these two behaviour change models were the first to highlight that individual decision making in relation to risk should be closely examined in the development of risk communication information. Since the introduction of these models, modelling efforts to inform hazard specific risk communication have become more widespread, and more complicated, particularly exploring the interdependent relationships between cognitive, social, environmental and structural factors that may influence a risk decision (See Figure 4 and Figure 5).
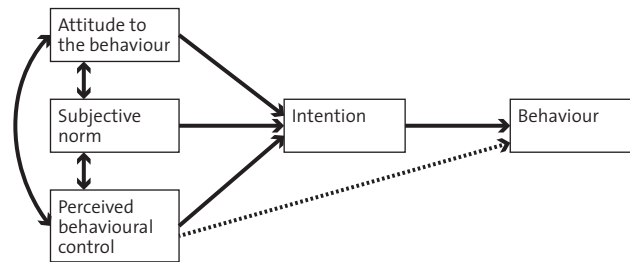

Figure 4: The theory of planned behaviour. Sourced from Ajzen (1991).

Figure 5 illustrates a generalised decision process people at risk of bushfire in Australia go through when asked about preparing for the hazard. It shows that the decision to prepare is initially a dichotomous one, where positive or negative outcome expectancy (belief that preparing will actually benefit them) – i.e. people who think preparing won't help, choose not to prepare. Whether or not people think preparing is beneficial, they nevertheless draw on interactions with their community, and considerations about the place in which they live in order to bring context to their choice. Here sense of community and the ability to interact with friends and neighbours to mitigate wildfire risk helps them to develop an intention to prepare. Only once this process is completed are at-risk individuals likely to undertake protective behaviours.

Figure 6 identifies the factors that were shown to influence household flood mitigation behaviour in a survey of residents in the German city of Cologne. [5] Like figure 5,
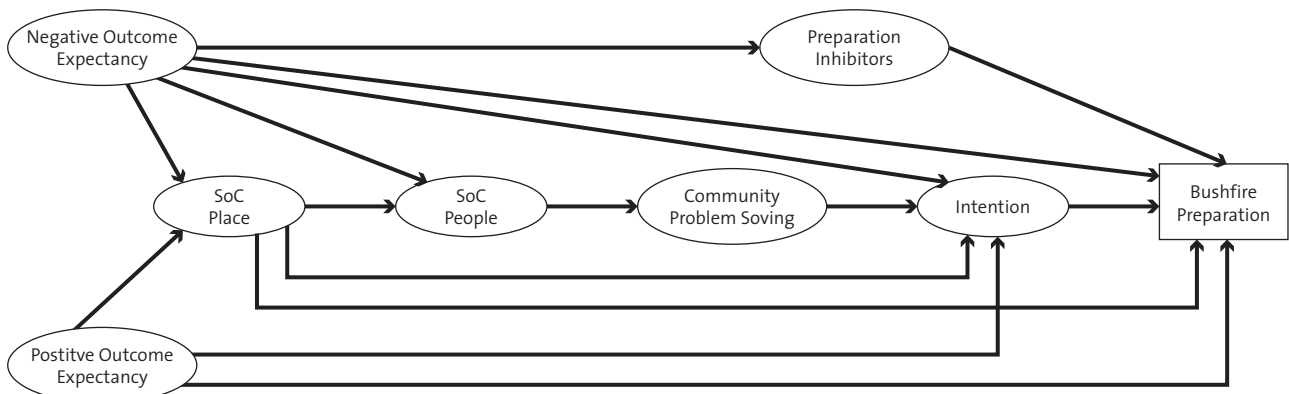

Figure 5: Model of individual decision making illustrating decision cues in the choice to prepare for bushfire in Australia. Sourced from Paton et al. (2008).
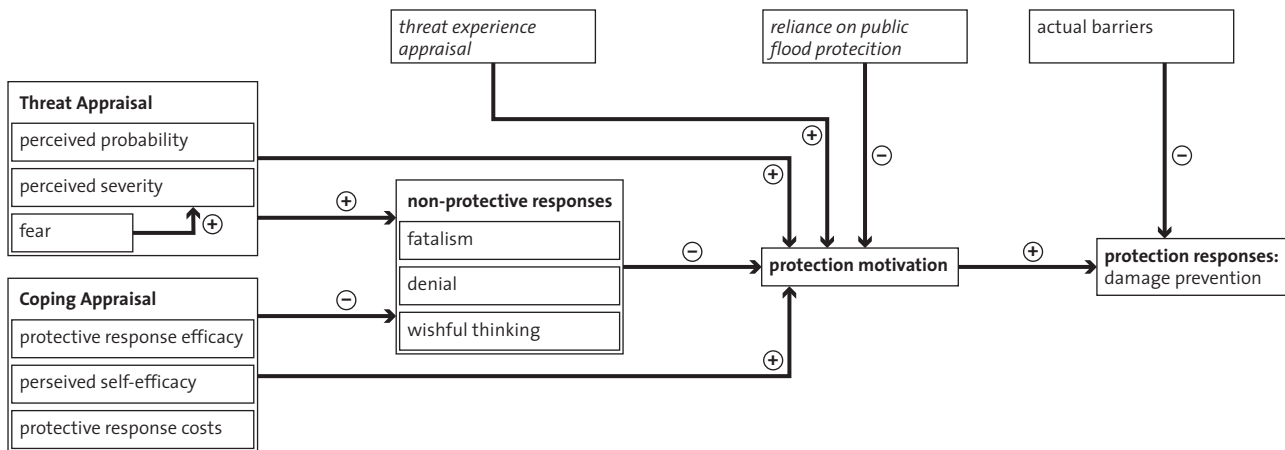
Figure 6: Factors influencing household decisions about mitigating flood risk in Cologne, Germany. Sourced from Grothman and Ruesswig, 2006).

the model incorporates socio-psychological factors to illustrate how households adapt to avoid damage from flooding. The model is based on another theoretical behaviour model, the 'protection motivation theory',[57] which particularly highlights three elements in a risk-related decision about protection: a consideration about the threat itself (threat appraisal below); the ability of the choice-maker to apply cognitive skills to mediate between their beliefs or knowledge of the threat and their behaviour (coping appraisal and non-protective responses, protection motivation); and lastly, a behaviour change component (protective responses).

While risk communicators expect those people who receive their information to follow the advice they provide in a logical and rational manner, the theoretical and empirical models presented here illustrate that individuals' decisions about responding to risk information, and hazards, is very complicated. Risk communicators perceive the information and advice they provide to the public to be objective, rational and warrant rational action. Their outreach materials are derived from the substantial knowledge gained through the experience of their organisations and the information they provide is based primarily on that experience. The material risk communicators produce and distribute is therefore elucidated by the communicator's mental model of risk, and considered to be objectively rational. However, to be meaningful and understandable, risk communicators must acknowledge and address the multiple cues on protective behaviour decisions (section 4.5 discusses how different risk communication techniques can do this; Risk Fact Sheet 9 also provides extensive information on adequately targeting at-risk populations with risk information). Determining which cues to address when developing risk information, based on their relative importance, is another challenging task. Ultimately it is possible to find evidence that almost any factor may have an influence on decision making (*e.g.* culture, emotional situation etc.), but this challenge should not preclude an investment of time and

resources into developing and deploying new and innovative risk information presentation or dissemination techniques.

4.4 Demographic characteristics

The ability to respond effectively to risk information, and to risk, is also influenced by the demographic characteristics of the at-risk population. Understanding and correctly interpreting risk information, being prepared or adopting protective behaviours can be influenced by a wide variety of factors (including age, ethnicity, gender, income, wealth, education, population movement). As such, when developing a risk message and targeting risk information at vulnerable populations, these demographic factors should also be considered.

Age is an important demographic issue affecting people's behavioural responses to risk information. For the very young and very old, responding to risk information (of any sort) may be impossible. Such people rely on others to assist them in their response, and risk information typically encourages more capable individuals to provide this assistance. However, the old and the young then must also rely on their 'helpers' properly interpreting the risk information and acting on it. Ethnicity raises similar barriers, with people of foreign languages and cultures either requiring assistance, or specially targeted information, to adequately respond to risk information. Previous reports have highlighted the need to target particular vulnerabilities with specific risk information, or communication techniques,[4] and these are likely to increase the ability of people challenged by age and/or ethnicity to respond to risk information.

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4   See: Roth, F. and Brönnimann, G. (2013): Using the Internet for Risk Communication, Focal Report 8, Center for Security Studies, ETH Zurich; Roth, Florian (2012) Visualizing Risk, Focal Report 9, Center for Security Studies, ETH Zürich; Roth, F., Giroux, J., Herzog, M. (2014): Using (the right) media to reach the audience: Best practices of media use in public risk communication, Risk and Resilience Reports, Factsheet 9, Center for Security Studies, ETH Zürich.

Increasingly, researchers are directing attention toward understanding how gender influences public risk mitigation activities.[5, 58] In the cases of hazards where the mitigation activities are physically demanding, men are often more likely to undertake the activities. However, whether they choose to respond to hazard information, or if this is encouraged by other people (like the woman of the house for instance), varies. In the cases of food risks and perceived risk from genetically modified organisms,[4, 59] women are more likely than men to perceive risk and respond to risk information (by selectively buy food for instance, or encouraging others in the house to join them in making flood preparations). In the case of hazards like wildfire and flood, men are more likely to undertake protective behaviours, but are often stimulated to undertake these actions by women. Consequently, the risk response, or hazard mitigation, is strongly influenced by the gender of the information receiver in an at-risk household.

Income, wealth and education (often associated with demographic classes) are significant factors that influence risk perception and hazard preparation. Recent research on flooding in the United Kingdom indicates a strong linkage between these demographic factors and the awareness of flood risk.[60] The work also illustrated that demographic characteristics such as income and education, which can influence the vulnerability of different sectors of society, could result in social stigmatisation against the vulnerable. Being classed as 'at-risk' often led to a resentment of the risk information given the probable negative social and material implications of this labelling. In the study of flood risk they concluded that flood experience, length of time at present address, residential tenure, and age (all of which are connected to class divisions in the United Kingdom) had an important effect on whether flood preparedness measures were undertaken in the household.[60] Someone who owns an expensive house would likely invest more time and funds clarifying and addressing their risk situation, than a renter who has recently relocated to the 'at-risk' area. In addition, the level of education has been shown to correlate strongly and positively to a better understanding of risk information messages, and the translation of these messages into action.[61–63]

While demographic factors do explain variances in the risk awareness and protective behaviours of the public, the interaction between these characteristics and other factors complicate a clear view of the role demography plays in hazard mitigation. In particular, Breakwell points out that the effect of demographic factors on risk perception and action varies with respect to the specific risk.[2] For example, in relation to health risks, gender and age are important influencing, while education and wealth play a stronger influencing role in the case of natural hazards. As has been shown in section 4.3, examining the influence of demographic factors simultaneously with other environmental or socio-cognitive factors can be more informative than examining them in isolation.

4.5 Passive and active risk communication

There are two generic modes by which risk communicators can disseminate risk information to the at-risk public: by using passive or active techniques. Most commonly, risk information is delivered using passive mass communication techniques (such as brochures, videos or websites) that contain general information about the risk, and ways that people can mitigate this risk. While resource efficient, such passive techniques rely on the receiving individual understanding and interpreting the information in the way that it is intended by the risk communicator. More active risk communication techniques (such as community meetings and risk dialogue) are gaining in popularity, and aim to engage individuals directly, thereby disseminating information in a way that becomes significantly more relevant to the receivers context and situation.
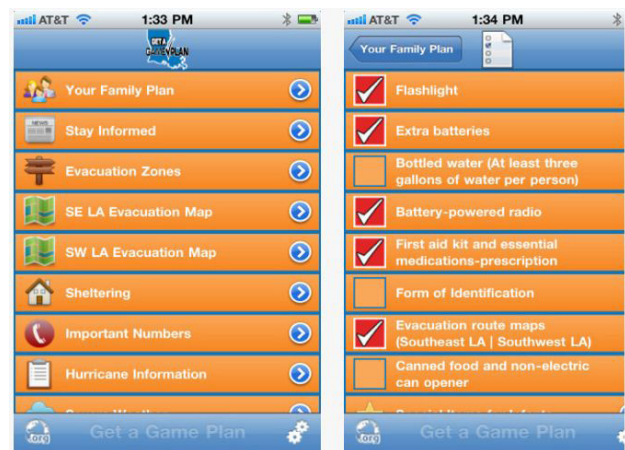
Figure 7: Louisiana State's 'Get a Game Plan' App is designed to provide both passive and active information about weather-related hazards in the state.

Given the nature of people's decision making, and the contextual nature of hazard risk, passive risk information cannot suit everyone all the time (*e.g.*, as a result of differences in demographics, knowledge, prior behaviour, etc). Passive techniques focus more on the messages provided to the community rather than on producing information that is both understandable and meaningful: two characteristics that catalyse action by enabling people to connect with the information and realise its value within the context of their lives. Importantly, it is not information per se that determines action, but how people interpret it (*i.e.*, render it meaningful) in the context of their experiences, beliefs and expectations.[64–66] Figure 7 is a screen shot from a weather hazards app developed by the Louisiana State emergency management agency. It

provides an example of a form of communication where passive information (for example, about what should be in the family's emergency plan) mixed with a mechanisms that allow the information receiver to interact with the information in an active way.

An example illustrates one difficulty presented to risk communicators when using a passive approach. Researchers have shown that individuals often transfer their own responsibility for preparedness onto emergency management agencies after receiving risk information.[67] These authors suggest that the actions of emergency management agencies in constructing and passively disseminating preparedness and warning information may reduce public perceptions of vulnerability, because risk communication is often suggestive of the emergency services' presence and capacity. This misperception can transfer the community's responsibility for their own safety solely to risk management agencies. This issue represents a form of 'cognitive bias' known as risk compensation,[33] which reflects how people balance their perceptions of how safe the environment is with their need to act to enhance their safety – the presence of, or communication by hazard management agencies causes people to believe they are at less risk, and consequently overlook the need to undertake protective behaviours.

Irrespective of whether messages are understandable or meaningful, a failure to accommodate the relationship between the risk communicator and the information receiver can be a major limitation to the effectiveness of a risk message. Because risk messages are communicated to people who already have developed experiences, beliefs and expectations about hazards and their management, they are often subject to circumstantial interpretation. For example, Prior and Paton[68] observed that some older members of a community affected by a severe wildfire were unlikely to seek or respond to current risk communication information because they felt they had gained sufficient knowledge about wildfire through their previous experiences, even if that knowledge was outdated and contrary to current risk messages. People's previous experiences with the veracity of risk messages,[31] or agency warnings,[42] their experiences with the people who deliver these messages, and their own perceptions about the likelihood of hazard activity may all contribute to the extent individuals listen to or rely on the information contained in risk messages. Most importantly, individuals receiving risk information must have confidence that the actions detailed in that information are safe and, based on positive past experiences, demonstrate a 'common sense' (where sensible is determined by the individual based on their experience, beliefs, attitudes etc) approach to mitigating risk: if not, the information is unlikely to be acted on.

In general, the problems with passive risk communication techniques lie partly with their inability to reach every individual all of the time, and partly because the message is not universally meaningful. People's emotions, beliefs, experiences and attitudes towards natural hazards, as well as their interaction with other people, all determine how people interpret, respond to and act on the information with which they are provided. As such, one risk message, structured in one way, and delivered using one or two inflexible media can never hope to inspire an effective and broad-scale response. While some people are able to use this information because it suits their beliefs, knowledge or awareness about a risk or hazard, others are unable to place it in the context of their lives or lifestyles.

While the mass communicated nature of much risk information generally invites open and varied interpretation by the receiver, more active communication can do just the opposite. In order to understand how people react to a risk situation, it is therefore necessary to delve into the individual characteristics that determine their perception of risk and the way in which they construct risk based on their own circumstances. Deeper examinations of the construction of risk in this way, using techniques that can open discussion about the factors that might prevent people from acting on risk information, can better inform the development of effective risk communication.

Active risk communication[5] is based strongly on closer engagement between risk managers and people living at risk.[23] Engagement entails not only public participation in risk management processes, but should permit or encourage information sharing and problem solving among at risk communities and between the community members and risk management agency representatives. Figure 8 shows a risk manager discussing wildfire risk mitigation actions with people living in a wildfire risk area of South Australia.

Figure 8: Active risk communication. Local residents discussing wildfire risk mitigation measures in South Australia. Image courtesy of the South Australian Country Fire Service.

4.6   The inherent uncertainty of natural hazards and risk heuristics

The consequences of many of life's decisions are plagued by uncertainty, so each decision an individual makes incorporates an assessment of the "desirability of possible outcomes and their likelihood of occurrence".[51, p.269] The more often an individual makes a decision surrounded by uncertainty, assessing these two attributes (possible outcome and probability of occurrence), the better that person *may* become at judging the consequences and making an appropriate decision. However, where uncertainty is present, rational decision-making is not always given.[52]

People often do not reach rational decisions as a result of their cognitive reasoning – partly because of the social construction of risk, and partly because active cognition is undertaken with the information at hand, and often with deduction aimed not at reaching a rational outcome, but to reach the most agreeable outcome.[69, 70] It is quite clear that an individual's judgement can be biased by their beliefs, attitudes, feelings and emotions at the time the decision is made (I liked the car's colour and forgot to look under the bonnet), leading to illogical choice. Tversky and Kahneman [71] showed that individuals rely heavily on 'affect heuristics' to guide their judgement, enabling them to simplify otherwise difficult choices. But once the choice is simplified in this way, judgemental errors are likely to become more common.

Most natural, social and technological hazards are rare, unpredictable, and pose unfamiliar risks. Under such ambiguity and uncertainty, risk-related choices can't be informed by familiarity for several reasons: because people lack experience; because conceiving of the consequences is difficult; and because a lack of knowledge about the risk complicates the response. In these circumstances, uncertainty and unfamiliarity contribute to the hazardous nature of the circumstances in which people find themselves. What confounds the individual's decision-making further is the fact that the consequences of poor judgements or inadequate information processing can be life threatening – which introduces an element of 'dread' fear.

Tversky and Kahneman [71] showed that people assess the probability of uncertain events using several judgemental heuristics. Although the heuristics of representativeness (judgements are based on similarities with known elements), availability (frequency by which events can be recalled) and anchoring (judgements about an event are determined based on perceived starting points) provide workable mechanisms by which individuals formulate ideas about uncertain events, they mostly result in judgemental errors. Whether people employ such heuristic principles to educate their conceptualisations of risk and probability is not a function of their desire to understand uncertain events, but simply to compensate for the little knowledge they possess about these events, whose effects might be clarified if they can develop some idea as to why or how they might operate.

Therefore, uncertainty is essentially a state of 'not knowing'. Members of the public are generally limited by their own knowledge, the knowledge of others, the knowledge that exists around them, an inability to find out (and having to rely on second-hand information) or a combination of these. Under these circumstances people attribute probabilistic judgements to risks in order to legitimise their 'not knowing' by asserting that although unpredictable, a risk is nevertheless possible within some future time frame. Risk communicators have often resorted to communicating probabilities in order to engender responses to environmental risk, yet these techniques are now shown to be next to useless partly because they perpetuate these states of 'not knowing'.

Distressingly, even when people don't know, they must nevertheless make decisions about hazard risk. The fundamental uncertainty of hazards has dramatic influences on whether people actually choose to undertake the protective behaviours communicated by risk management agencies. If people believe that the chance of a hazard occurring is minimal, then they are unlikely to consider mitigating the risk from that hazard as important – particularly when there are many other pressures in life that require more immediate attention. What people know, but also what they don't know, can affect the way they interpret risk information, their perceptions of that risk, whether they feel they require more information about the risk, and whether they should act to mitigate the effects of that risk. So the uncertainty of hazards plays a key role in determining how people respond to the threat such risks pose and the information available about them.

5   Effective risk communication: understanding decisions and encouraging action in Switzerland

Connecting with the public through meaningful risk communication processes is likely to become increasingly important in Switzerland in the future. Simply because the urban population areas in the country are becoming more dense means that the consequences, if disaster does strike, will be more severe – where severity is

measured in deaths and injuries, destroyed or damaged infrastructure, and disrupted services. Climate change predictions for Switzerland, which indicate more frequent and severe storms (resulting in flooding, landslides, liquefaction, etc) among other impacts, are cause for added concern – because disasters are social phenomena (caused by hazard activity), increased population density magnifies disaster severity. Under such circumstances it will become more necessary for the Swiss Federation, Cantons and Communities to share the burden of mitigating hazard impacts. Risk communication that considers (among other issues) the points explored in this report, can help to inform the development of effective risk communication.

Risk communication techniques that are based on the perception of risk are confounded by the fact that perception of risk does not necessarily spur protective behaviour. Recent studies contend that while risk perception may be an antecedent of behaviour change, it does not determine the adoption of risk mitigation actions, and that socio-cognitive processes "underpin behaviour change and its maintenance over time."[25, p.210] Therefore, simply providing 'targeted' risk information and relying on the receiver's perception of their risk as a means to increase preparedness for natural hazards does not yield sufficient public behaviour or attitude change. Given this difficulty, we suggest six recommendations that can improve the way people interpret and act on risk information – both in a manner that reflects risk managers' intentions, and the nature of the risk or hazard.

1. **Engaging with the at-risk public.** Responding to hazard risks is a shared responsibility – risk managers can help the public to prepare, and a coordinated public response can reduce the need for risk managers to seek hugely resource intensive solutions to manage risk. Developing risk messages and information together with the target audience can be a useful way of identifying misunderstandings and misinterpretation of risk messages. 'Road-testing' risk messages and delivery channels before the dissemination of the information, and incorporating feedback from the information receivers can increase the efficacy of risk communication dramatically. Finding ways to foster social connection and discussion about risk or hazard at the community level is a good way to increase people's awareness of hazard and counteract inaction.

2. Risk communicators should expect **that not all people will prepare for hazards** that they might be threatened by. Even if risk information is clear, and presented using a communication channel that suits the target audience, other influential factors can reduce the salience of risk information. This is especially the case if a hazard is uncertain, unpredictable, or the likelihood of threat is low. The possibility that a natural hazard will have consequences (also uncertain) for an individual is treated much like the other issues they deal with in their everyday lives, and those issues that occur more often are more likely to be considered of higher importance.

3. Risk communicators should be aware that the **risk information they distribute may not be acted on in the way it is intended**. Depending on the information receivers, the risk message used, and the technique used for risk communication, information may cause fear, inaction, or even cause individuals to falsely transfer responsibility for mitigating risk to the risk manager. However, the vast majority of research and experience shows that if done well, and thoughtfully, risk communication does encourage people to take proactive action to mitigate risk. While experts have technical knowledge of risk, and an objective understanding of why acting to mitigate risk is important, laypeople may not share this knowledge. Becoming aware of risk is a process of learning, and the learning process cannot be considered complete simply if risk information is passively transferred to an at-risk audience. The public should not be excluded from discussions about possible risk.

4. Using a **mix of active and passive risk communication techniques**. Presenting information regularly, through different media, and in different ways can be a useful way of increasing the salience of hazard risk as well as reaching a bigger part of the target group. Some people can incorporate mass communicated information seamlessly into their daily lives, while others require assistance contextualising information and interpreting it in their own situations. By providing risk information using only one mode of dissemination, the risk communicator automatically limits the utility and uptake of that information.

5. Using information in a way that **complements individual thinking about risk, rather than downplaying it**. Risk managers should seek to gain an understanding of the way the public thinks and feels about risk, and develop risk information and messages that complements these thoughts and feelings. Just correcting people's mistakes, misunderstanding, or misinterpretation should not be the objective of risk communication. People make decisions about risk based on a rationalisation process, which may differ between experts and laypeople. Importantly, laypeople are not necessarily wrong, but may require particular information that helps them to understand risk in a way that reflects the expert's view. The extensive connectivity between civil society and civil protection as well as the technical knowhow in Switzerland should therefore be leveraged for designing recipient-oriented, helpful risk information messages.

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18

CRN REPORT

Factsheet

Through the Prism of Complexity: Insights for governance from the complex adaptive systems perspective

Zurich, November 2009

Crisis and Risk Network (CRN)
Center for Security Studies (CSS), ETH Zürich

Commissioned by the Federal Office for Civil Protection (FOCP)

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