Social determinants of risk perception

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Abstract

Risk perception is an issue for all, whether project proponents, expert assessors or project affected communities. There have been substantial advances in understanding the nature of risk perception from the psychological sciences. In this literature review, the following models are described: information deficit, social amplification, psychometric, cognitive biases and cultural worldview. Evidence suggests that risk perceptions are often biased by how the brain works. The biases are likely to affect impact assessors as much as other stakeholders. An amplified perception of risk by a project community may be a social determinant of health, as it may cause stress and anxiety and demands for what may be regarded as excessive mitigation. An attenuated perception of risk by project proponents, impact assessors or communities may lead to what may be regarded as insufficient mitigation. Use of risk perception models may enable impact assessors to understand, classify and respond to the reactions of multiple stakeholders.

Introduction

The assessment of project impacts may be influenced by many factors. The scope of this paper is limited to perception and characterization of risk. Risk can be characterized in different ways: a risk assessment matrix categorizes risk according to severity and likelihood in order to determine significance (Birley, 2011). The assumption is made that well-informed people will rank risks so that reasonable mitigation measures can be advocated. But what if that is not consistently true? The challenge seems particularly acute when the issues are complex, uncertain or ambiguous (Klinke & Renn, 2002); and this is often the case in impact assessment.

Research describes a disconnection between perceptions of risk by environmental health specialists and affected communities (Stewart *et al*, 2010; Luria, Perkins, & Lyons, 2009; Anon, 2014). The former rely on statistical estimates which the latter may not trust. The literature reviewed helps explain this difference.

Imagine that there is such a thing as a “fair” representation of a risk, one that would be agreed by a majority of stakeholders. Risk perceptions frequently seem to diverge from this fair representation, becoming amplified or attenuated by small or large margins. To make the point, consider two extreme examples. The risks associated with fracking for shale gas may seem amplified while risks associated with climate change may seem attenuated. But why is it this way around and why does divergence occur? Again, the literature reviewed provides some insight.

Perceptions of risk that are amplified may give rise to anxiety and other symptoms. For example, labelling land as potentially contaminated increased self-reported ill-health (Luria, Perkins, & Lyons, 2009). Perceptions that are attenuated may contribute to harmful decisions. Both anxiety and harm are health impacts.

In this paper the primary focus is Health Impact Assessment (HIA), although much of the discussion is more generally applicable.

Models of risk perception

Five interconnected models of risk perception are summarised below. They have been chosen to make a point. There are probably others.

Information deficit

The information deficit model assumes that if people are given more information their perceptions of a particular risk will change. This model seems to form the basis for much impact assessment. However, the assessment may not change the risk perceptions of either the project proponent or the affected community. Both are more likely to be influenced by feelings than by information. The literature on risk perception therefore examines how feelings arise.

Research suggests that when people feel negative, they overestimate risks and underestimate benefits, and vice versa (Slovic, 2010). The estimate of risk can be manipulated by changing the perceived benefit. This inverse relationship between benefit and risk is the opposite of what classical economics assumes: increasing risk is associated with increasing benefits.

Social Amplification

Communities may develop a consensus in which some risks are perceived as amplified and others attenuated (Kasperson, et al., 1988; Pidgeon, Kasperson, & Slovic, 2003). The psychological processes responsible for amplification and attenuation include attaching a feeling to memories. When a new risk is confronted, memory is triggered and associated feelings come to mind. For example, a large sewer project in London generated images of dark, smelly tunnels full of rats. This negative feeling created an adverse response. Some example of possible images for a range of project types are listed in Table 1. Such images can simply occur, regardless of whether they are fair or accurate.

Table 1 Examples of positive and negative images that could be associated with different kinds of projects

Project	**Images generating negative feelings**	**Images generating positive feelings**
London sewer	Dark, smelly tunnel, full of rats	Cleanliness, waste removal, flood prevention
Fracking for shale gas	Poisoning wells, climate change, rape of the earth, disruption	Cheap, clean, local energy
Agricultural resettlement for a reservoir in Sarawak	Angering the rice and river gods, loss of security, government interference	Clean energy, improved transport, employment opportunities
Oil in Nigeria	Dead fish, oil spills, crime, repression, corruption	Wealth, energy security, political power
New railway lines	Intrusion, disturbance, loss of place, stigma	Rapid transport, energy efficiency

Psychometric

The psychometric model was one of the earlier approaches to resolving the issue of what people feel (Slovic, Fischhoff, & Lichtenstein, 1982). The significance of a risk is likely to be determined by some of the parameters in Table 2. These parameters describe what can happen, but the underlying causes require further analysis.

Table 2 Some psychometric parameters with examples of relevance to HIA

Parameter	**Example**
Voluntariness	The owners of a policy or project are voluntary risk takers. They risk their finance or their reputations on a project. The project affected community are involuntary receivers of the risk.
Dread, aversion, horror	Some ways of dying are considered worse than others.
Children v adults	We protect our children more than ourselves.
Many v few	We consider risks that affect many people at the same time to be more significant than risks that affect individuals one at a time.
Familiarity	Familiar risks (oil wells) are often considered less significant than unfamiliar ones (fracking).
Contagion	Communicable diseases (Plague, Ebola) may be considered more significant than non-communicable diseases.
Distance in space and time	We may be more concerned with risks that are immediate and close by (incinerator) than risks that are distant in time and space (climate change).
Sympathy and generosity	We are less sympathetic towards a large number of sick people than towards a single, named, sick individual (Small, Loewenstein, & Slovic, 2007).

Cognitive bias and heuristics

Models of the mind suggest that humans have two modes of thinking (Kahneman, 2011). See Table 3. The term “affect” is used here to refer to feelings or emotions (Slovic, 2010). We have evolved to react quickly to immediate risks and we do so without deliberation. We tend to favour affective over analytic thinking to save time and effort. Our reactions use rules-of-thumb or heuristics (Gigerenzer, 2014). For example, "fear what your social group fears" prevents lethal experiments.

Table 3 Types of thinking with examples relevant to HIA

Type of thinking	Characteristic	Example
Affective	Fast, intuitive, automatic, emotional, use of heuristics	Anxiety about a risk based on gut reactions
Analytic	Slow, deliberative, effortful, computational	Judgement about a risk based on deliberation

Our initial response to new or complex risks tend to use the affective kind of thinking. In some cases, affective thinking is biased. Over a hundred such cognitive biases have been demonstrated experimentally (Kahneman, 2011). See Table 4.

Table 4 *Some cognitive biases (Kahneman, 2011) with examples relevant to HIA*

Type of bias	Example
Optimism	Project budget set too low with a timescale unrealistically short. See also Sharot *et al* (2007).
Framing	Narrow scoping that excludes some important but difficult issues.
Confirmation	Choosing evidence that fits preconceptions.
Certainty	Believing that all risks can be calculated (confusing risk and uncertainty).

Cultural World Views

Status anxiety helps explain why inequality is a social determinant of health and a driver of consumerism (Marmot, 2004; Wilkinson & Pickett, 2009; Marshall, 2014). Information about risk that challenges group identity may be perceived as a threat to status. A compelling example is the "White Male Effect" in the USA (Finucane *et al* 2000). In this experiment people rate a set of hazards on a numerical scale of risk. The hazards include smoking, AIDS and nuclear power. The sample is then disaggregated by gender and race and the mean score for each risk is calculated. For all the hazards listed, white males consistently estimate each risk as lower than do the other groups. Amongst white males, the average score is reduced by a privileged sub-group with fixed ideas about risk. Kahan *et al* (2007) suggest that the sub-group cannot accept new estimates of risks because they would lose status amongst their peers. They often believe either that they have exceptional control of their own destiny or that they can have faith in their leaders. The experiment has been repeated in Sweden, where gender equality is more pronounced and in that context the major discriminant was between natives and immigrants (Olofsson & Rashid, 2011).

In Impact Assessment the ranking of risk and severity is often undertaken by a privileged elite and their risk estimates may be biased accordingly.

Quantified risk assessment

Quantified risk assessment requires that the probabilities associated with each component of a risk are known. If the probabilities of some components are unknown, the risk cannot be quantified and this is referred to as uncertainty. "Certainty bias" describes the cognitive error where uncertainty is misclassified as risk. The best decision under risk is not always the best decision under uncertainty (Gigerenzer, 2014).

Making money out of risk perception

Large profits can be made by manipulating fear. "Merchants of doubt" make their profits out of attenuating fears to increase sales (Conway & Oreskes, 2010). Examples include tobacco smoking and climate change. "Merchants of fear" make their profits out of amplifying fears to increase sales (Gardner, 2009). Examples include newspapers, security products, pills and political platforms. The framing effect associated with changing the way that options are presented has a significant impact on choice (Kahneman, 2011). Care is required to ensure that impact assessments do not inadvertently serve the interests of the merchants of either doubt or fear.

Mitigation of perceived risk

Where a risk is amplified there is likely to be a recommendation for excessive mitigation. See table 5. For example, epidemic risk may led to the purchase of unnecessary and ineffective drugs (Gigerenzer, 2014). Where a risk is attenuated there is likely to be a recommendation for insufficient mitigation. Climate change provides an example as the mitigation measures that have been implemented to date are far from sufficient to manage the challenge described by the IPCC (Marshall, 2014).

Table 5 Mitigation of perceived risks with examples relevant to Impact Assessment

Perception	Mitigation	Examples
Amplification	Excessive	Fracking, BSE, contaminated land
Attenuation	Insufficient	Climate change, private transport, diet

The expected benefits of mitigation measures, and the benefits of projects and policies themselves, may be presented as though they were certain and this may also bias peoples responses (Ivanova *et al*, 2010).

Conclusion

Humans have not evolved to have an analytic understanding of risk and uncertainty (Gigerenzer, 2014). Risk perception occurs in a broader context including attachment to place and community (Baldwin, 2014), and political milieu. This brief review has highlighted some of the models that may enable impact assessors to understand, classify and respond to the reactions of multiple stakeholders.

An agenda for further work might include:

- Recognising our inherent biases so that we can manage them.
- Improving our understanding of risk perception, uncertainty and cognitive bias.
- Developing a classification system for the risk perceptions of key informants, project proponents, other stakeholders and ourselves.
- Using this knowledge to seek consensus about benefits, risks, priorities and appropriate mitigation measures.
- Placing risk perception in a broader social context.
- Improving risk communication processes using social media (Rutsaert, et al., 2015; Slovic, 2010).
- Testing risk perception mapping tools (Stoffle *et al*, 1991).

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