Chapter 5

The role of emotions in forming judgements about risks

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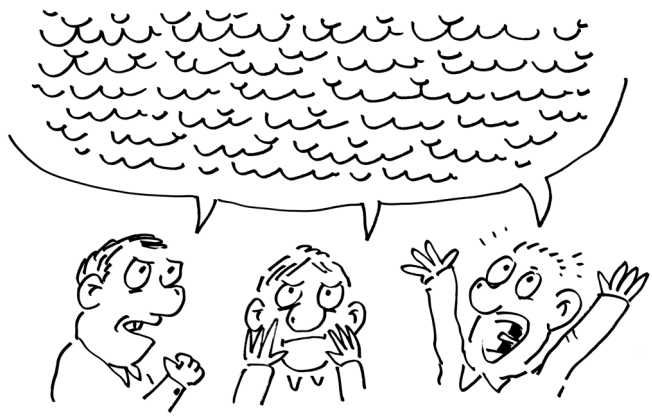
5.1 INTRODUCTION

5.1.1 Risk perception



This chapter focuses on the role of emotions in forming judgements about risk, and particularly judgements in the context of differentiation between risks caused by acts of nature versus human actions. The notion of risk is ambiguous. The most

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common technical definition of risk views it as a combination of the probability of an adverse event and the magnitude of its consequences (Rayner & Cantor, 1987). This simple approach to risk has been used extensively by experts, who define risk using only two dimensions: the objective probability of a specific event happening and the severity of the event's consequences. In contrast, risk perceptions of the general public are based on the subjective assessment of probabilities and the degree of concern about consequences (Sjöberg *et al.* 2004). Generally, public risk perceptions are based not only on technical and scientific descriptions of danger, but on more complex assessments than those used by experts, and are influenced by various psychological and social factors, such as personal experience, emotions, values, interests, worldviews, etc. (Slovic, 2000; Leiserowitz, 2005).

Analysis of the specific factors that have a decisive role in public risk perceptions has attracted much interest from both politicians and researchers. One of the most dominant and popular models in the field of risk perception research is the psychometric model developed by Slovic and his collaborators (Fischhoff *et al.* 1978, 1981; Slovic, 2000). In this model people's risk perceptions have at least 19 dimensions (Covello *et al.* 1988). However, only five of these are crucial for the evaluation of risks: severity of consequences, perceived event controllability, knowledge of risks, voluntariness of exposure, and dreadfulness (Slovic *et al.* 1982; Covello *et al.* 1988; Slovic, 2000; Fox-Glassman & Weber, 2016). These aspects of risk perception are measured by asking people to assess a risky situation or event based on several scales:

- Perceived event controllability is assessed as the degree of an individual's belief that they can influence a risk.
- Severity of consequences estimates the subjective likelihood that the consequences of the risky situation or event will be fatal.
- Knowledge of risks describes the extent of personal familiarity with the presented risks.
- Voluntariness of exposure evaluates whether people generally face the described risks voluntarily or not.
- Dreadfulness asks whether the risks presented are common risks that people have learned to live with, or whether they are risks that people dread greatly (Sjöberg *et al.* 2004).

In the present research topic – the difference in perceptions of risk between events caused by acts of nature and events caused by human actions – our attention focuses on three aspects that are closely linked to risk perception dimensions in the psychometric model: the general notion of risk, the severity of consequences, the degree of suffering caused by an event, and the unfairness of an event.

In our research, we use 'dangerousness' to assess general perceptions of the riskiness of a situation or event. The concepts of risk and dangerousness are used interchangeably both in laypeople's risk perceptions and in the literature (Tierney *et al.* 2001; Mansnerus, 2012). Both dangerousness and risk are ambiguous concepts (Leiserowitz, 2005) and their meanings in the context of risk assessment

vary from person to person. They can be used to describe the severity of negative consequences (Kogan & Wallach, 1964), to refer to the probability of occurrence of damage or harm (Moiraghi, 2007) or reflect dread (Rudski *et al.* 2011), the latter is directly comparable to the dimension of dreadfulness in the psychometric model. In the legal literature the term dangerousness refers to the probability of antisocial behaviour (cf. Kozol *et al.* 1972).

We also employ two closely related risk perception dimensions: severity of consequences and degree of suffering (both physical and psychological) caused by a negative event. These two dimensions focus on the negative consequences (damage) experienced by people exposed to risk. In contrast to the psychometric model, we assess severity of consequences in terms of seriousness of damage, which can be both financial and physical, and not as the probability of death resulting from an event. The dimension of suffering as a negative consequence of an event defines another aspect of damage, and was previously emphasized in research by Slovic *et al.* (1991) and Siegrist and Sütterlin (2014).

A fourth dimension used to assess risk perception in our work is an event's unfairness. This aspect is referred to as 'equity' in the psychometric model, and is used to define an equitable versus inequitable distribution of risks and benefits (Covello *et al.* 1988). Fairness is an important factor in risk acceptability and tolerance (Rayner & Cantor, 1987; Sjöberg, 1987; Nerb & Spada, 2001). People are more willing to accept risks if the distribution of risks and benefits is perceived to be just (Keller & Sarin, 1988). On the other hand, the unfairness of an event increases perceptions of the event's riskiness (Sandman, 1989; Gregory & Mendelsohn, 1993; Sjöberg & Drottz-Sjöberg, 2001).

Finally, we include a concept which we define as 'compensation for the exposure to a risky situation' (Viscusi, 1995; Janmaimool & Watanabe, 2014). Strictly speaking, compensation size is not a dimension of risk perception, but we believe it to be associated with the severity of consequences and perceived suffering dimensions (Bromley, 1992; Ritov & Baron, 1994; Kunreuther, 2002; Baan & Klijn, 2004).

5.1.2 Hazards and emotions

An increasing body of evidence suggests that, in addition to cognitive processes, emotions have an enormous impact on risk perception and assessment processes (Kunreuther, 2002; Sjöberg, 2007, 2012; Nguyen & Noussair, 2014). Authors such as Finucane *et al.* (2000), Loewenstein (2001) and many others (e.g., McDaniels *et al.* 1995; Slovic & Peters, 2006) consider that emotions are a central factor in risk perception. Finucane *et al.* (2000) developed the 'affect heuristic' concept, as a mediator of the relationship between risks and benefits in individual risk assessment. This heuristic postulates that individuals automatically assess events or other entities as 'good' or 'bad'. 'Good' entities evoke positive feelings and are subsequently perceived as safe, and 'bad' entities evoke negative feelings and are perceived as risky (Rudski *et al.* 2011). Instead of basing their judgements of risk

on objective facts, people tend to use their feelings (affect) about specific hazards to assess the risk associated with them (Slovic & Peters, 2006; Siegrist & Sütterlin, 2014). In a similar fashion, the risk-as-feelings model of Loewenstein *et al.* (2001) emphasizes the important role of feelings, in addition to cognitive evaluations, in people's behaviour. Note that Zajonc (1980) also suggested that an emotional component dominates people's decisions and behaviours, since emotional (affective) evaluation occurs automatically before any conscious processing can take place.

In risk analysis, emotional reactions can be expressed both as affect (negative or positive: Sjöberg, 2000; Sokolowska & Sleboda, 2015) or specific emotions, especially negative ones (Lerner & Keltner, 2001; Sjöberg, 2007). Böhm (2003) suggests that, in contrast to general affect, concrete emotions carry specific semantic content and thus provide better information about individual risk perceptions and behavioural tendencies. Different types of emotions perform different roles in risk perception (Böhm, 2003). Specifically, moral emotions may be important for human judgement and decision-making (Spranca *et al.* 1991; Boyce *et al.* 1992; Harris & Brown, 1992; Walker *et al.* 1999). Models of risk perception that include an 'unnatural and immoral risk' factor have higher predictive value than models without such a factor (Sjöberg, 2000).

Moral emotions are evoked by violations of moral rules or obligations and subsequent moral concerns (Roberts, 2010; Landmann & Hess, 2016), and can be directed at either the perpetrator (e.g., anger for transgressions), the victim, (e.g., compassion for suffering and pain) or the self (e.g., shame for being unable to stop a perpetrator). Haidt (2003) distinguishes four families of moral emotions: other-condemning emotions (contempt, anger and disgust), self-conscious moral emotions (shame, embarrassment and guilt), other-suffering moral emotions (distress at others' distress and sympathy/compassion) and other-praising moral emotions (gratitude, awe and elevation). He notes that there are also other emotions which can be considered moral but which do not fall into the above four categories, for example, schadenfreude and, in some circumstances, fear; Haidt (2003: 864) calls these 'marginal or non-prototypical moral emotions'. Similarly, Böhm and Pfister (2000) suggest classifying moral emotions, or as they term them 'ethics-based emotions', into other-directed (disgust, contempt, outrage, anger and disappointment) and self-directed (guilt and shame) ethical emotions.

5.1.3 The study's aim

'Origin of hazard' is one of the risk perception dimensions used in the psychometric model: it addresses the question of whether a risk is caused by an act of nature or by human actions (Covello *et al.* 1988). Laypeople tend to perceive human-made risks as riskier than those caused by natural factors. Specifically, human-made risks are perceived as being scarier, more dangerous, causing more suffering, and having more severe outcomes; their fatalities are seen as being less acceptable than those occurring as the result of natural hazards (Rudski *et al.* 2011; Siegrist & Sütterlin,

2014). When given a choice, people prefer to be injured due to a natural cause rather than an artificial cause (Rudski *et al.* 2011). Similarly, people's willingness to prevent harm caused by humans is greater than their willingness to prevent the same harm resulting from natural causes (Kahneman *et al.* 1993; Kahneman & Ritov, 1994). In line with these findings, in our study we expected that, when harm occurred due to human action, a risky situation would be perceived as more dangerous and unfair, the damage it caused would be considered to be more severe and a victim's suffering to be greater, and, consequently, that a victim would be said to be entitled to higher monetary compensation for exposure to a risky event.

Human-made hazards also evoke more intense emotional reactions than natural hazards. Stronger negative affect is observed in response to disasters caused by humans than natural disasters (Rudski *et al.* 2011). Moreover, human-made hazards often evoke blame, anger and outrage directed at the responsible agents (Nerb & Spada, 2001; Böhm, 2003). In contrast, natural hazards require no assignment of responsibility since they are beyond anyone's control (they are inevitable) and can affect anyone (Nerb & Spada, 2001). Thus, the acceptance of natural cycles results in more favourable assessment of natural hazards compared to disasters caused by humans that can be avoided if controlled (Weiner, 1995; Siegrist & Sütterlin, 2014). Consistent with this previous research then, in our study we also expected emotional responses to hazards caused by humans, expressed both as negative affect and specific moral emotions, to be stronger than emotional responses to natural hazards.

Emotional reactions play a mediating role between type of hazard (human-made or natural) and perceived risk (Xie *et al.* 2011). In line with Böhm (2003) we hypothesized that specific emotions, both those directed at a perpetrator (e.g., anger and outrage) and a victim (e.g., compassion and sadness), would be better at predicting risk perceptions than negative affect, due to the specific semantic content that they carry.

This chapter aims to conduct a thorough examination of the structure of emotional responses to natural and human-made hazards and their impact on the perception of risks embedded in specific hazards. First, we compare the perceived riskiness of hazards with the same harmful consequences when caused by nature versus human actions. Then we examine differences in emotional responses to events caused by nature and humans. Finally, we analyse the impact of various emotional responses evoked by hazards on perceptions of hazards' riskiness.

5.2 METHOD

5.2.1 Participants

Two hundred participants were randomly assigned to one of four treatments: 50 participants per treatment. Of the 200 participants, 101 were female and 99 male, equally distributed across treatments. Participants had a mean age of 43 years ($SD = 9.55$). This specific age structure was chosen since we believed that life experience, which increases with age, might be beneficial in completing the

experimental tasks. Moreover, older participants have been found to be better at expressing emotional reactions (Miesen, 2011), which was beneficial in answering our research questions. Participants were compensated for their participation and informed that they had to correctly answer three control questions included in the scenarios used in order to get a reward for their participation. These questions ensured that participants carefully read the scenarios presented to them. Data were only analysed for participants correctly answering all control questions.

5.2.2 Materials and procedure

5.2.2.1 Scenarios

The experimental scenarios described situations in which protagonists suffered harm. This harm had either a human-cause (1a) or was caused by nature (1b). Moreover, irrespective of the cause of harm, the type of harm caused to the protagonist was either physical (2a) or material (2b: i.e., harm was caused to the protagonist's property causing financial loss). Thus, a first treatment variable was perpetrator with two levels: human versus nature. A second treatment variable was harm with two levels: physical versus financial. The two treatment variables were incorporated in short scenarios consisting of descriptions of a single event which were presented to participants. The content of each scenario is summarized below, and precise descriptions of the scenarios can be found in Appendix A:

- *Nature-Financial*: A protagonist lives in a house situated in an area prone to floods. This area is protected by a levee. Due to heavy rains, the level of water in a nearby river recently increased. One day the levee was overtopped by water and many houses, among them the protagonist's house, were flooded.
- *Human-Financial*: A protagonist lives in a house, which is situated in an area prone to floods. This area is protected by a levee. Due to heavy rains, the level of water in a nearby river recently increased. The levee was broken on the orders of the governor of the district, whose house was in an area unprotected by the levee a few kilometres down the river. This was done to protect his house from flooding, but as a result many houses, among them the protagonist's house, were flooded.
- *Nature-Physical*: A protagonist went on a long-planned trip to Morocco. She planned to visit many places. However, during the second day of her visit an earthquake occurred. During this earthquake the protagonist suffered an open fracture of a thighbone and after being treated in hospital had to return immediately to her home country.
- *Human-Physical*: A protagonist went on a long-planned trip to Morocco. She planned to visit many places. However, during the second day of her visit a terrorist detonated a bomb. As a result of the explosion the protagonist suffered an open fracture of a thighbone and after being treated in hospital had to return immediately to her home country.

In the scenarios participants were instructed to take on the role of a sibling of the protagonist and try to experience the emotions that they would experience in the aftermath of the events described. According to Sjöberg (2000) the 'risk target is a factor of great importance in risk perception', since people tend to assess risk differently according to whether the target of a risky situation is a member of their family (or themselves) or the general population. Thus, by defining the risk target as a participants' family member we attempted to make them become actively engaged in the experimental task and have a higher degree of empathy with protagonists in the experimental scenarios, to the extent that they would experience stronger feelings about the stories presented.

5.2.2.2 Emotional response measurement

Two types of emotional response were measured. First, we assessed participants' general emotional reactions to scenarios, henceforth this is referred to as negative affect. For this, participants were asked to express their feelings after reading a scenario on a scale ranging from 'very negative' (1) to 'very positive' (11). Second, we evaluated the specific emotions experienced by participants after reading a scenario. Here, participants were presented with a set of predefined emotions and asked to evaluate which of them they experienced. They evaluated each of the presented emotions on a scale ranging from 'haven't experienced at all' (1) to 'experienced very intensively' (11). Emotions were presented to participants in random order.

Choice of specific emotions

In accordance with Izard's (1997) theory of emotions, and in line with the findings of Sjöberg (2007) who found that negative emotions are more important than positive emotions in predicting risk perceptions, we selected nine predominantly negative emotions from the Geneva Emotions Wheel (GEW; Scherer, 2005; Scherer *et al*. 2013). These emotions are: sadness, regret, compassion, disgust, contempt, anger, disappointment, hate and fear. Since some of these emotions represent responses to the bad deeds of others and some represent responses to bad things experienced by others, we find it useful to further group the emotional terms into 'other-condemning' (disgust, contempt, anger, disappointment and hate) and 'other-suffering' (sadness, regret and compassion) emotions. Note that since fear could be both a reaction to the bad deeds of others and a reaction to others' suffering (e.g., fear for loved ones) we consider it to be a mixed-emotion and do not include it in these emotion groups.

5.2.2.3 Risk perception

For the present work, we adopted the consequentialist view of risk perception suggested by Böhm and Pfister (2000): evaluation of the consequences of a negative event consists of not only evaluating potential negative consequences

but also negative consequences that are already present. Based on theoretical considerations and previous empirical applications (Fischhoff *et al.* 1978; Slovic *et al.* 1980; Ritov & Baron, 1994; Nerb & Spada, 2001; Rudski *et al.* 2011; Siegrist & Sütterlin, 2014) five items (questions) were chosen to measure various dimensions of risk perception:

- How much did a person suffer due to the negative event?
- How severe was the damage to the person as a result of the event?
- How dangerous do you think the event was?
- How unfair was the event?
- What (monetary) compensation should the protagonist get for their suffering in the described situation from a fictitious EU Assistance Fund which helps victims of unfortunate events?

To evaluate the first four risk perception items, participants used a scale ranging from 'not at all' (1) to 'very (much/severe/dangerous/unfair)' (11). Monetary compensation could be offered in the range 1 to 50 thousand PLN. Risk perception items were presented to participants in random order. The instructions for the 'Compensation size' risk perception item can be found in Appendix B.

5.3 RESULTS

Perpetrator: Nature versus Human

Table 5.1 presents the mean values of specific risk perception items for each of the two perpetrator-type treatments: nature and human. Statistical tests for all five risk perception items revealed significant differences in the perception of damage occurring between events attributable to natural and human causes, the results suggesting that incidents caused by humans are evaluated as riskier than those caused by nature, even when event outcomes are the same.

Table 5.1 Risk perceptions for the perpetrator treatments: nature versus human.

Items	Cause of Event				$N_N = N_H$	*M-Wp*
	Nature		Human			
	M	*SD*	*M*	*SD*		
Perceived suffering	8.14	1.90	8.79	1.93	100	0.001
Perceived severity of damage	7.93	1.72	8.40	1.80	100	0.023
Perceived dangerousness	6.57	2.73	7.36	2.52	100	0.034
Perceived unfairness	6.55	2.78	8.13	2.55	100	0.000
Size of compensation	25.89	16.99	31.71	16.35	100	0.012

Note: For items 1 to 4 scales ranged from 1 (not at all) to 11 (very much); for item 5 values ranged from 1 to 50 thousand PLN; N_N and N_H are sample sizes for the nature and human scenarios. *M-Wp* is the two-sided probability of Mann-Whitney tests.

The emotional reactions reported by participants are presented in Table 5.2. As in previous research (cf. Siegrist & Sütterlin, 2014), for the most part, the events caused by humans resulted in significantly stronger emotional reactions than those caused by nature, the only exceptions being the non-significant results for compassion and disappointment.

Table 5.2 Emotions experienced in response to the perpetrator treatments: nature versus human.

Emotion	Item				$N_N = N_H$	*M-Wp*
	Nature		Human			
	M	*SD*	*M*	*SD*		
Affect[a]	9.36	1.83	9.80	2.21	100	0.003
Sadness	8.92	2.38	9.81	1.85	100	0.002
Regret	9.03	1.97	9.22	2.62	100	0.028
Disappointment	6.12	3.06	6.69	3.68	100	0.135
Fear	7.30	3.08	7.96	3.28	100	0.050
Disgust	2.71	2.49	4.85	3.75	100	0.000
Contempt	2.48	2.13	5.07	3.72	100	0.000
Hate	2.60	2.32	6.06	3.82	100	0.000
Anger	7.22	2.83	8.57	2.94	100	0.000
Compassion	9.63	1.72	9.40	2.71	100	0.210

Note: For the intensity of specific emotions scales ranged for 1 (not at all) to 11 (very much); N_N and N_H are sample sizes for the nature and human scenarios. *M-Wp* is the two-sided probability of Mann-Whitney tests.
[a]Affect was reverse recoded on a scale ranging from 1 (positive) to 11 (negative).

Harm: Financial versus Physical

Table 5.3 presents the mean values of specific risk perception items for each of the two harm treatments: financial versus physical. Overall, the results suggest that incidents resulting in financial harm are evaluated as riskier than those causing physical harm. Participants' decisions to offer significantly higher compensation for financial harm than for physical harm were consistent with these findings.

Table 5.3 Risk perceptions for the harm treatments: financial versus physical.

Items	Cause of Event				$N_F = N_P$	*M-Wp*
	Financial		Physical			
	M	*SD*	*M*	*SD*		
Perceived suffering	8.16	2.30	8.77	1.46	100	0.135
Perceived severity of damage	8.41	1.84	7.92	1.67	100	0.011
Perceived dangerousness	7.46	2.48	6.47	2.74	100	0.008
Perceived unfairness	7.43	2.94	7.25	2.62	100	0.306
Size of compensation	35.14	15.57	22.46	15.80	100	0.000

Note: For items 1 to 4 scales ranged from 1 (not at all) to 11 (very much); for item 5 values ranged from 1 to 50 thousand PLN; N_F and N_P are sample sizes for the financial and physical harm scenarios. *M-Wp* is the two-sided probability of Mann-Whitney tests.

The emotional reactions of participants based on type of harm to the protagonists are presented in Table 5.4. Except for marginal differences in sadness and compassion, emotional reactions did not differ between the treatments.

Table 5.4 Emotions experienced in response to harm treatments: financial versus physical.

Emotion	Item				$N_N = N_H$	*M-Wp*
	Financial		Physical			
	M	*SD*	*M*	*SD*		
Affect[a]	9.76	2.03	9.40	2.04	100	0.106
Sadness	9.12	2.30	9.61	2.03	100	0.092
Regret	8.88	2.41	9.37	2.20	100	0.138
Disappointment	6.60	3.41	6.21	3.37	100	0.376
Fear	7.70	3.08	7.56	3.30	100	0.998
Disgust	4.02	3.65	3.54	3.02	100	0.572
Contempt	3.97	3.49	3.58	3.08	100	0.484
Hate	4.08	3.61	4.58	3.59	100	0.348
Anger	7.88	3.02	7.91	2.91	100	0.945
Compassion	9.09	2.72	9.94	1.61	100	0.074

Note: For intensity of specific emotions scales ranged for 1 (not at all) to 11 (very much); N_F and N_P are sample sizes for the financial and physical harm scenarios. *M-Wp* is the two-sided probability of Mann-Whitney tests. [a]Affect was reverse recoded on a scale ranging from 1 (positive) to 11 (negative).

5.3.1 The structure of emotional reactions and risk judgements

Correlational analysis showed that many of the specific emotions evoked by the experimental treatments were significantly correlated with each other (see Appendix C). This indicates that subjects experienced several similar emotions at the same time. Factor analysis was therefore conducted to discover 'bundles' of emotions. An initial factor analysis revealed a structure of emotions loading on two factors: five on a first factor and four on a second factor. However, subsequent examination suggested exclusion of the fear item from the factor analytic solution. The fear item was removed based on a criterion presented in Hair *et al.* (2014: 120), which suggests removing items with communalities below 0.50: the communality of fear was 0.38. Additional criteria for the decision were (1) quite a low correlation between this item and the total score for the initial scale ($r = 0.38$), and (2) improvement of scale reliability after the removal of fear from 0.72 to 0.77.

This decision was also consistent with the criterion of judging solutions by their 'interpretability and scientific utility' (Tabachnik & Fidell, 2013: 647). According to Böhm (2003) and Xie *et al.* (2011), fear clearly belongs to a group of emotions which have a 'prospective' character, yet the initial factor analysis assigned it to the 'retrospective' group. The fear item was analysed as a separate emotion in further analyses.

Table 5.5 presents respecified factor loadings for emotion ratings after VARIMAX rotation. This solution corresponds to our theoretical distinction between emotion types (other-condemning and other-suffering emotions) and to Böhm's (2003) distinction between ethics-based other-directed and consequence-based retrospective emotions. The first factor, which involves other-condemning emotions, has high loadings for disgust, contempt, hate, anger and disappointment. The second factor, which reflects other-suffering emotions, has high loadings for regret, sadness and compassion.

Table 5.5 Factor analysis of emotion ratings: rotated factor loadings.

Emotion	Factor 1 Other-Condemning Emotions	Factor 2 Other-Suffering Emotions
Disgust	0.880	–0.151
Contempt	0.870	–0.109
Hate	0.850	–0.011
Anger	0.633	0.441
Disappointment	0.578	0.270
Sadness	0.198	0.827
Regret	0.015	0.808
Compassion	–0.166	0.796
Explained variance (%)	39.04	27.56
Cronbach's α	0.83	0.77

An index for each of the two factors (i.e., emotion bundles) was computed by taking participants' mean ratings across all of the emotions that loaded highly on a factor. These indices had acceptable internal consistency as measured by Cronbach's α (see Table 5.5). Further analyses were conducted with the two calculated 'bundles' of emotions, and, as mentioned above, fear as a separate emotion.

As can be seen in Figure 5.1, the strength of the other-condemning and other-suffering emotions differed depending on the source of threat. However, the difference was much greater in the case of other-condemning than other-suffering emotions.

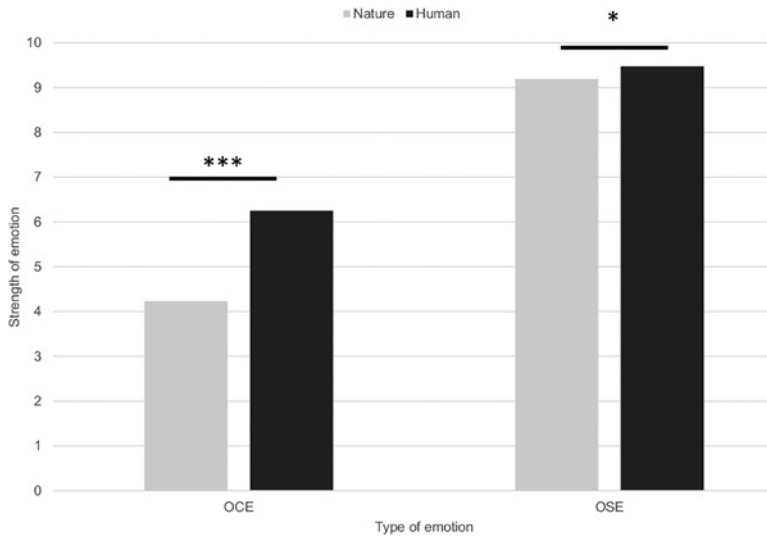

Figure 5.1 Other-condemning and other-suffering emotions experienced in response to the two perpetrator treatments: nature versus human. U Mann-Whitney ***$p < 0.001$, *$p = 0.028$.

5.3.2 Mediation analyses

In the next step we tested whether any of the emotional reactions expressed by participants were predictors of responses to risk perception items. Here, for each risk perception item separately, we constructed a model allowing transmission of treatment effects through several mediation mechanisms simultaneously, namely other-condemning emotions (OCE), other-suffering emotions (OSE), fear, and negative affect (NA). Although significant, the correlations between NA and the specific emotions were low, suggesting that there were no problems with multicollinearity in the mediation analyses (see Appendix D). Since we found no significant differences between financial and physical harm with respect to emotional reactions, we concluded that emotions had no explanatory power in accounting for differences in risk perception between these scenarios. Therefore, we did not perform separate analysis for the harm treatments and concentrated our analysis only on the perpetrator treatments. Results of mediation analyses are summarized in Appendix E.

Emotional reactions as a mediator between the perpetrator treatment variable and perceived dangerousness

The relationship between perpetrator-type and the dangerousness risk perception item was mediated by NA. As Figure 5.2 illustrates, the regression coefficient

for the perpetrator-type – NA relationship was statistically significant, as was that for the NA – perception of dangerousness relationship. We tested the significance of the indirect effect (0.16) using bootstrapping procedures, and the bootstrapped 95% confidence interval suggested that the indirect effect was statistically significant (CI95 = [0.008, 0.444]).

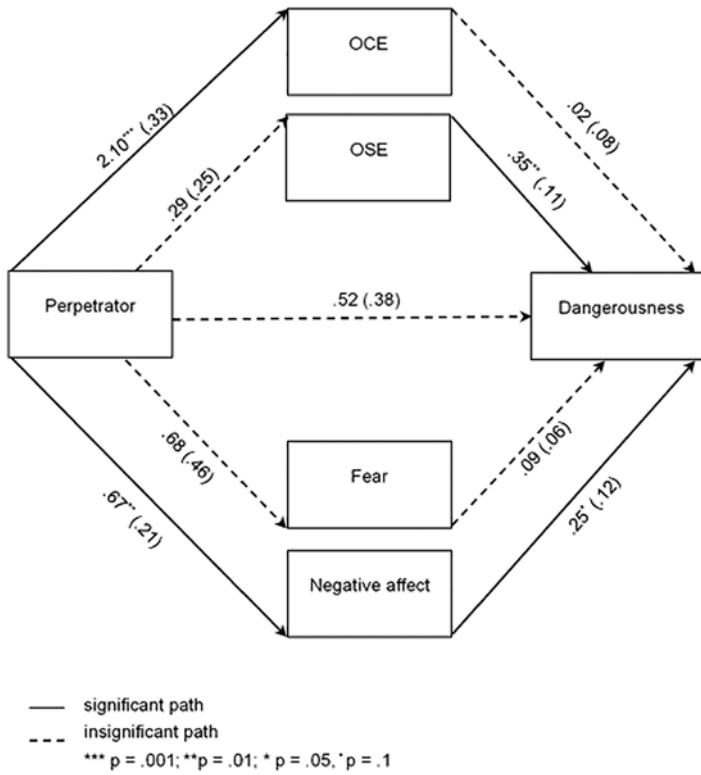

Figure 5.2 Mediation analysis for perceptions of dangerousness.

Emotional reactions as a mediator between the perpetrator treatment variable and perceived severity

The relationship between perpetrator-type and the severity risk perception item was partially mediated by both the OCE and NA. As Figure 5.3 illustrates, the regression coefficient for the relationship between perpetrator-type and OCE was statistically significant, as was that for the relationship between OSE and the severity risk perception item. Also, the regression coefficients for the relationships between type of perpetrator and NA, and NA and perceived severity were

statistically significant. The significance of the two indirect effects (OCE = 0.21; NA = 0.20) was tested using bootstrapping procedures. The bootstrapped 95% confidence intervals (OCE: CI95 = [0.015, 0.423]; NA: CI95 = [0.057, 0.419]) suggested that both indirect effects were statistically significant. Next, we tested which indirect effect was stronger (Hayes, 2013), that is, which of the mediators accounts for more of the effect that perpetrator-type had on the severity risk perception item. The difference between the two indirect effects (0.01) was insignificant (C95 = [–0.271, 0.285]), thus we concluded that the indirect effects were of similar strength.

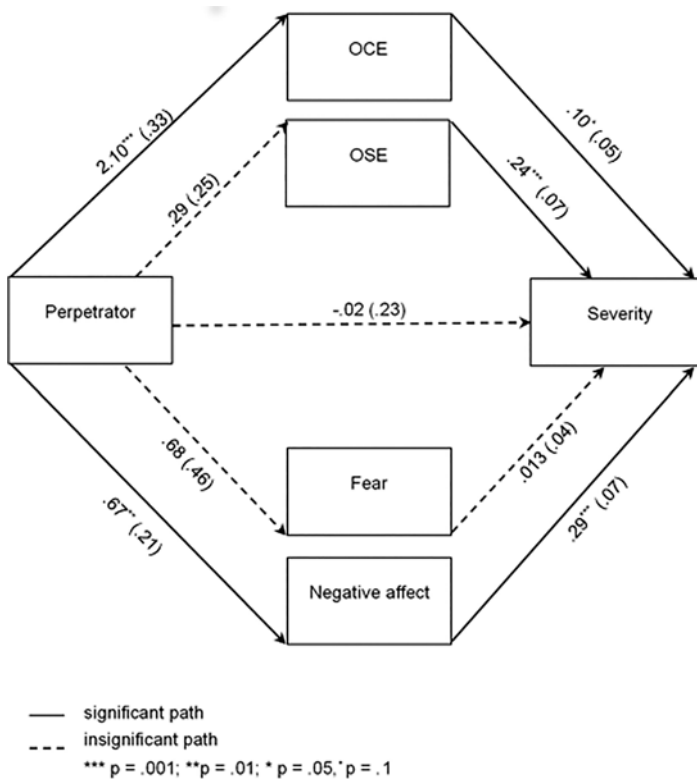

Figure 5.3 Mediation analysis for perception of severity.

Emotional reactions as a mediator between the perpetrator treatment variable and perceived suffering

The relationship between perpetrator-type and the suffering risk perception item was mediated by NA. As Figure 5.4 illustrates, the regression coefficient for the

perpetrator-type – NA relationship was statistically significant, as was that for the relationship between NA and perception of suffering. The bootstrapped 95% confidence interval (CI95 = [0.066, 0.428]) suggested that the indirect effect (0.20) was statistically significant.

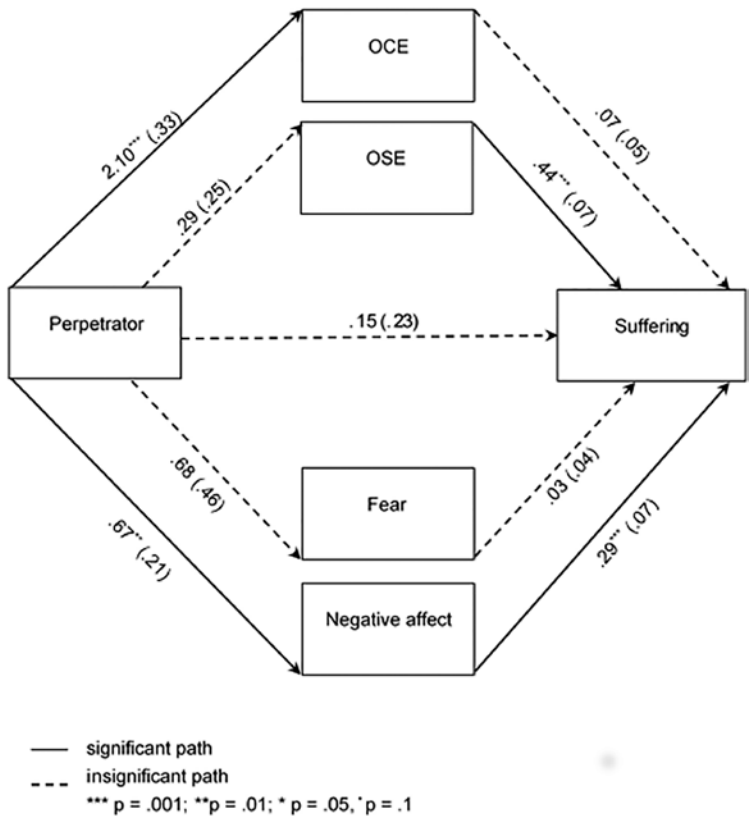

Figure 5.4 Mediation analysis for perception of suffering.

Emotional reactions as a mediator between the perpetrator treatment variable and perceived unfairness

The relationship between perpetrator-type and the unfairness risk perception item was partially mediated by both the OCE factor and NA. As Figure 5.5 illustrates, the regression coefficient for the relationship between type of perpetrator and OCE was statistically significant, as was that for the relationship between OSE and the unfairness risk perception item. Also, the regression coefficients for the relationship between type of perpetrator and NA, and NA and perceived unfairness

were statistically significant. Again, we tested the significance of the two indirect effects (OCE = 0.56; NA = 0.18) using bootstrapping procedures. The bootstrapped 95% confidence intervals (OCE: CI95 = [0.266, 0.942]; NA: CI95 = [0.025, 0.435]) suggested that both indirect effects were statistically significant. We then tested which indirect effect was stronger to see which of the mediators had the greatest role in explaining the relationship between perpetrator-type and responses to the unfairness risk perception item. The difference between the two indirect effects (0.38) was non-significant (CI95 = [−0.007, 0.835]) and we concluded that the indirect effects were of similar strength.

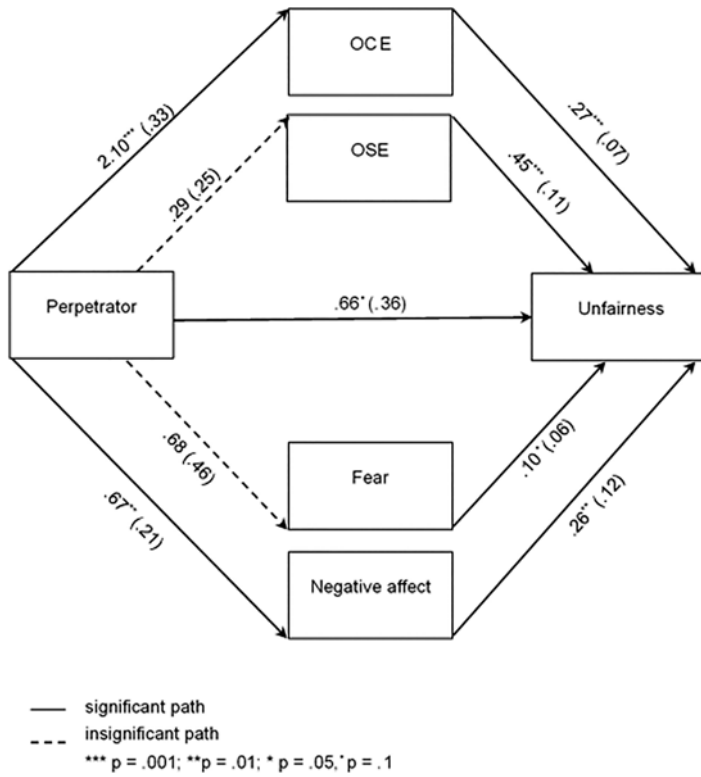

Figure 5.5 Mediation analysis for perceived unfairness of the event.

5.4 CONCLUSIONS

Our research leads to several important conclusions. First, results showed that a hazard's origins influence its perceived riskiness. When the cause of harm was human action rather than nature, a situation was perceived as more dangerous and

unfair, damage was considered more severe, a victim's suffering greater and higher compensation for the victim was recommended. Generally, these differences are in line with the results of previous research showing that harm caused by humans is perceived as riskier (Xie *et al.* 2011), more dangerous (Rudski *et al.* 2011), more severe (Siegrist & Sütterlin, 2014; Rudski *et al.* 2011), and as causing more suffering (Siegrist & Sütterlin, 2014) than harm resulting from natural events. Second, emotional responses to hazards caused by humans are generally stronger than emotions evoked by natural hazards. We compared three types of emotional responses: general NA and two types of moral emotion – OCE and OSE. Our results revealed that, relative to natural hazards, hazards caused by humans evoked stronger NA, as well as OCE (i.e., a mixture of disgust, contempt, hatred, anger and disappointment) and OSE (i.e., a mixture of sadness, regret and compassion). The intensity of OSE was much greater than OCE in both natural and human-made risky situations. Thus, witnessing the victim's distress and pain induced a very high level of OSE in comparison to OCE, irrespective of the origins of harm.

Both of these results – the influence that a hazard's origins have on its perceived riskiness and the stronger emotional response elicited by hazards caused by humans – accord with the idea that human-made risks are less accepted than risks attributable to natural causes. This suggests that the harm caused by the breaking of a levee under the orders of a local authority to prevent the flooding of highly populated areas would evoke stronger negative reactions than equal harm resulting from natural causes, for example, the natural breaking or overflowing of the levee. Presumably, people would expect higher financial compensation for a loss resulting from human action than for an objectively equal loss caused by the forces of nature. This provides a suggestion for efficient risk management in hazard prone localities. Meeting resident victims' expectations regarding compensation for losses would result in an increase in the trust in authorities and as such could induce more cooperative behaviour in response to future hazards. For example, trust in authorities increases compliance with evacuation orders (Paul, 2012; Rød *et al.* 2012).

Additionally, we analysed which, if any, negative emotional reactions mediate the differences in perception of natural and human-caused risky situations. First, we found that, for all four dimensions of risk perception, NA was a significant mediator of the difference in perceptions of natural and human-caused risky situations. In other words, perceiving risky situations caused by humans as more dangerous, as causing more harm and suffering and as being more unfair than naturally-caused risky situations, was mediated by the stronger NA felt when a hazard was human-made than when it was caused by nature. Similarly, for some dimensions of risk perception – dangerousness and victims' suffering – OCE were a significant mediator of the difference in perceptions of natural and human-made risky situations. That is, perceiving a risky situation caused by a human as more dangerous, and as causing more suffering than a naturally-caused risky situation, was mediated by the stronger OCE felt when a hazard was human-made and not caused by nature. Thus,

the emotions evoked by a human perpetrator contributed to the final evaluation of human-made risks as being higher than risks caused by nature. The mediation effect of OSE was however small and insignificant. A possible explanation for this finding could be the fact that OSE were extremely high in both natural and human-made risky situations. This is in line with Böhm and Pfister (2005), who found that such emotions as sympathy, sadness and sorrow, or as they call them 'consequence-based emotions', were less affected by the risk origin and were generally highly independent of whether the hazard was nature or human-caused.

The fact that fear did not influence risk perception might be surprising, since there are studies showing such influence. Lerner *et al.* (2003) for example showed, that participants feeling more fear gave higher probability estimates of risks terror-related as well as not terror-related than participants feeling less fear. However, this might be due to the fact that fear is an emotion that precedes the occurrence of the consequences while in the scenarios used in the study negative consequences have already occurred, thus other types of emotions – for example, anger or hatred – became more important.

The above results show that both types of emotional reactions – general NA and certain moral emotions (specifically, OCE) – are responsible for differences in risk perception occurring between human-made and naturally caused hazards. In other words, attributing harm to a human perpetrator increases people's negative emotional reactions. Stronger negative emotions in turn lead to a situation or activity being perceived as more dangerous, having more severe consequences, causing more suffering, etc. So, increases in perceived risk can be an effect of the affect heuristic: the worse we feel when contemplating a situation/activity the more dangerous and the more harmful we find it.

Fischhoff *et al.* (1978) studied methods of informing the public about risks and involving them in policy decisions. They focused on so-called 'fault trees', that is, schematic, hierarchically organized representations of possible causes of undesired outcomes or events. These are simple devices for analysing and evaluating things that could go wrong. One of the main findings was that people were rather insensitive to factors left out of a fault tree, ignoring factors that were not explicitly stated. Another finding was that people perceived a particular branch as more important when it was presented piecemeal, for example, a single branch representing the breaking of levees by water would mean more for a person if it was presented as two branches: (1) penetration of levees, and (2) water overflowing levees.

This type of technique is likely to be useful for making residents of flood-prone areas more aware of a range of possible causes of hazard-related loss. In particular, such increased awareness would be desirable where residents are inclined to succumb to the so-called 'safety illusion', that is, feeling safer than is justified because of the existence of some form of protection such as a levee (see Chapters 9 and 10 for more on the safety illusion). The devising of a fault tree might be an efficient way of stimulating residents' awareness of the range of possible causes of a hazard. Including different

aspects of human activities in such an analysis would increase the availability of causes and the probabilities assigned to them when thinking of the hazard.

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APPENDIX A: EXPERIMENTAL SCENARIOS

Nature-financial

Imagine that you have a brother named Peter. Peter and his wife live in a house that his wife has inherited from her aunt. The house is very comfortable and located in a nice place, and Peter really likes it. The house is located on a flood plain. The river is protected by a levee. Flooding has not occurred in the area for a long time. Recently, heavy rains dramatically increased the level of water in the river. One night, the water overtopped the levee and many houses in the area, among them

the house of Peter, were flooded. Water flooded basements and reached 30 cm in rooms on the ground floor.

Human-financial

Imagine that you have a brother named Peter. Peter and his wife live in a house that his wife has inherited from her aunt. The house is very comfortable and located in a nice place, and Peter really likes it. The house is located on a flood plain. The river is protected by a levee. Flooding has not occurred in the area for a long time. Recently, heavy rains dramatically increased the level of water in the river. A village a few kilometres down the river, which had no flood embankment, was threatened. The governor of the district had a house in this village. One night, without notice to residents, to avoid flooding the governor's house, the levee was broken in the village where Peter lived, with the full awareness that many homes would be flooded. After breaking the levee many homes in the area, among them the house of Peter, were flooded. Water flooded basements and reached 30 cm in ground floor rooms.

Nature-physical

Imagine that you have a sister named Kasia. Kasia is a primary school teacher. It is hard work because she works with a variety of children, including children with special needs. Kasia is very dedicated to her work and the kids love her. During the winter holidays she decided to go for a long-deserved vacation and went on a week's trip to Morocco. She had been dreaming of this trip for a long time and saved-up for it. She was very glad that she would see famous Moroccan cities such as Casablanca, Marrakech and Fez. On the second day, when she was in the old town of Marrakech, there was an earthquake. The strength of the shock was so great that the facades of buildings collapsed and Kasia suffered an open fracture of a thighbone. Kasia is now in hospital and after receiving first aid she will return to Poland. Her insurance covers the costs of treatment and her return to the country, but she will not recoup the money she spent on the trip.

Human-physical

Imagine that you have a sister named Kasia. Kasia is a primary school teacher. It is hard work because she works with a variety of children, including children with special needs. Kasia is very dedicated to her work and the kids love her. During the winter holidays she decided to go for a long-deserved vacation and went on a week's trip to Morocco. She had been dreaming of this trip for a long time and saved-up for it. She was very glad that she would see famous Moroccan cities such as Casablanca, Marrakech and Fez. On the second day, when she was in the old town of Marrakech, there was a terrorist attack – a bomb exploded. The explosion

of the bomb planted by the terrorist was so strong that the facades of buildings collapsed and Kasia suffered an open fracture of a thighbone. Kasia is now in hospital and after receiving first aid she will return to Poland. Her insurance covers the costs of treatment and her return to the country, but she will not recoup the money she spent on the trip.

APPENDIX B: COMPENSATION

Imagine that there is an EU Assistance Fund. This fund pays compensation to victims of adverse events or misfortune for the pain and suffering associated with these events. Typical compensation ranges from 1 to 50 thousand PLN. Kasia/Peter got in touch with this fund. In your opinion, what compensation should Kasia/Peter get from the EU Assistance Fund?

APPENDIX C: PEARSON CORRELATION COEFFICIENTS FOR RELATIONSHIPS BETWEEN DIFFERENT EMOTIONS

Emotion	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sadness (1)								
Regret (2)	0.542**							
Disappointment (3)	0.219**	0.256**						
Fear (4)	0.353**	0.339**	0.252**					
Disgust (5)	0.070	–0.088	0.396**	0.098				
Contempt (6)	0.102	–0.042	0.371**	0.024	0.759**			
Hate (7)	0.146*	0.015	0.331**	0.171*	0.697**	0.676**		
Anger (8)	0.455**	0.243**	0.406**	0.325**	0.389**	0.404**	0.486**	
Compassion (9)	0.537**	0.491**	0.025	0.251**	–0.195**	–0.168*	–0.083	0.176*

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

APPENDIX D: PEARSON CORRELATION COEFFICIENTS FOR RELATIONSHIPS BETWEEN NEGATIVE AFFECT AND SPECIFIC EMOTION FACTORS

Emotional Reaction	(1)	(2)	(3)
Negative affect (1)			
Other-condemning emotions (2)	0.234**		
Other-suffering emotions (3)	0.383**	0.107	
Fear (4)	0.229**	0.221**	0.380**

**Correlation is significant at the 0.01 level (2-tailed).

APPENDIX E: SUMMARY OF MEDIATION ANALYSES RESULTS

Emotional Reaction	Risk Perception Measure			
	Dangerousness	Severity	Suffering	Unfairness
Negative affect	+	+	+	+
Other-condemning emotions	–	+	–	+
Other-suffering emotions	–	–	–	–
Fear	–	–	–	–

Note: (+) mediation effect; (–) no mediation effect.