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The perceiver's social role and a risk's causal structure as determinants of environmental risk evaluation

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We present a dual-process risk perception model that integrates cognitive and emotional as well as consequentialist and deontological components by distinguishing between two modes of evaluative processing: (a) a consequentialist evaluation that focuses on potential consequences and (b) a deontological evaluation that focuses on moral values. Each of these two modes is assumed to trigger specific cognitive evaluations, specific emotions, and specific behavioral tendencies concerning a perceived risk. We conducted an experiment ($N = 270$) that tested whether the relative dominance of the two evaluative modes would depend on the causal structure of the environmental risk being evaluated and on the social role of the evaluator. Three types of causal structure were varied by providing scenario information: (a) anthropogenic risks that endanger only nature, (b) naturally caused risks with potential harmful consequences for humans, and (c) anthropogenic risks that may harm humans. Participants evaluated each scenario from the perspective of one of three social roles: mayor, expecting parent, and environmental activist. For each scenario, participants specified their focus and evaluated the event's morality and perceived risk, the intensity of specific emotions, and their preferences for prospective behaviors. Results showed that the consequentialist evaluation was generally stronger than the deontological evaluation and was less affected by the experimental manipulations. The deontological evaluation was substantially affected by the risk's causal structure. It was stronger for anthropogenic than for natural causation; risks caused by humans were associated with greater perceived moral blameworthiness, more intense morality-based emotions (e.g. outrage), and a stronger tendency to perform agent-related behaviors (e.g. aggression) than naturally occurring risks. The effect of the social role was less pronounced than that of the causal structure. Furthermore, the effect of an evaluative focus on behavior was fully mediated by emotions for deontological evaluations and partially mediated for consequentialist evaluations. The implications for environmental risk perception and communication are discussed.

Keywords: risk perception; environmental risks; emotion; morality; dual process model

Introduction

Two topics have become increasingly popular in the risk perception literature: emotion and morality (Böhm and Tanner 2013; Roeser 2010). Beginning more than two decades ago (Pfister and Böhm 1992), affect and emotion have become a 'hot'

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topic in the areas of risk perception and decision-making (Peters et al. 2006), and several authors have documented the manifold ways in which judgments, risk perceptions, and decision-making are influenced by emotions (e.g. Loewenstein and Lerner 2003; Pfister and Böhm 2008; Roeser 2010; Slovic 2010; Zeelenberg et al. 2008). Likewise, morality has been increasingly emphasized as an important issue that plays a role in people's risk evaluations (e.g. Böhm and Pfister 2000, 2005; Ericson and Doyle 2003; Sjöberg 2000). It has even been argued that moral considerations are primary and shape our understanding of actions and events (Knobe 2007). It seems that environmental risks in particular are considered moral issues by many people (Böhm and Tanner 2013; Feinberg and Willer 2013; McDaniels, Axelrod, and Slovic 1995).

A model of the risk evaluation process that explicitly incorporates both emotion and morality was proposed by Böhm and Pfister (2000, 2005; see also Hendrickx and Nicolaij 2004). They distinguish consequentialist evaluations from deontological evaluations and show that these two types of evaluations result in different types of emotional reactions and trigger different types of behavior. We aimed to test several aspects of this model. First, for both emotions and behaviors, the model implies a distinction between consequence-related and morality-related ones. We wanted to test this classification of emotions and behaviors. Second, the model assumes that people focus on either consequences or deontological considerations when they evaluate a risk event. We wanted to investigate whether people's focus depends on two types of influences, namely, on features of the risk event, on the one hand, and on contextual factors, on the other hand. A fundamental feature of a risk is the risk's causal structure, that is, the types of causes that have brought about the event and the types of consequences that may occur. A fundamental contextual feature is the evaluator's social role (e.g. politician, parent).

In the next section, we describe Böhm and Pfister's model in more detail. We then present an experiment in which we presented participants with scenario information about fictitious environmental risks. By varying the information given in a scenario about the causes and consequences of the environmental risk, we manipulated the risk's causal structure. In addition, we instructed participants to evaluate the risk from the perspective of one of three social roles (mayor, expecting parent, and environmental activist) that we assumed would differ in the extent to which they shifted the focus of attention to either consequence-related or morality-related aspects of the risk event. We measured participants' evaluative focus (consequentialist vs. deontological), their cognitive judgments of the risk scenario (consequentialist and moral judgments), their emotional reactions, and their behavioral tendencies vis à vis the risk scenario. In the results section, we first report the results of analyses that tested whether emotions and behavioral tendencies could be classified as consequence-related vs. morality-related. We then present the effects of causal structure and social role on the evaluative focus, cognitive judgments, the intensity of emotional reactions, and the strength of the behavioral tendencies that were triggered by the risk scenario. We conclude with a mediation analysis that tested the prediction that the effect of an evaluative focus on behavioral tendencies would be mediated by emotional reactions.

The process of subjective risk evaluation

Böhm and Pfister (2000, 2005; Böhm 2003) proposed a dual process model that postulates two modes of risk evaluation and several stages within each mode.

According to the model (Figure 1), the vantage point of the risk evaluation process is a mental representation that the person constructs from available information. The most important components are the causes and consequences that the person ascribes to a risk event, construing a causal mental model of the risk event. As an example, think of an oil spill. Among other things, a person's mental representation of the oil spill contains the causes and consequences that the person ascribes to the spill. The person may believe, for example, that the spill was brought about by a reckless ship crew that disregarded safety measures, and that the spill will result in the deaths of many sea birds.

It is assumed that two modes of evaluative processing operate on the mental representation of a risk event: (a) a consequentialist evaluation, which focuses on potential consequences and their harmfulness, and (b) a deontological evaluation, which focuses on the involved actors and their actions and on the question of whether any moral values or norms are violated. Each of these two modes is assumed to trigger specific cognitive judgments, specific emotional reactions, and specific behavioral tendencies. This connection between cognitions, emotions, and behaviors builds strongly on appraisal theories of emotion (Frijda 2006).

A consequentialist focus leads to consequentialist judgments (e.g. the estimated severity and probability of consequences), consequence-based emotions (e.g. fear triggered by the anticipation of future harmful consequences), and consequence-related behaviors (behaviors that are aimed at preventing, avoiding, or alleviating harmful consequences, e.g. cleaning up an oil-polluted beach). A deontological focus, on the other hand, is associated with judgments of moral reprehensibility, morality-based emotions (emotions triggered by the violation of moral norms, e.g.

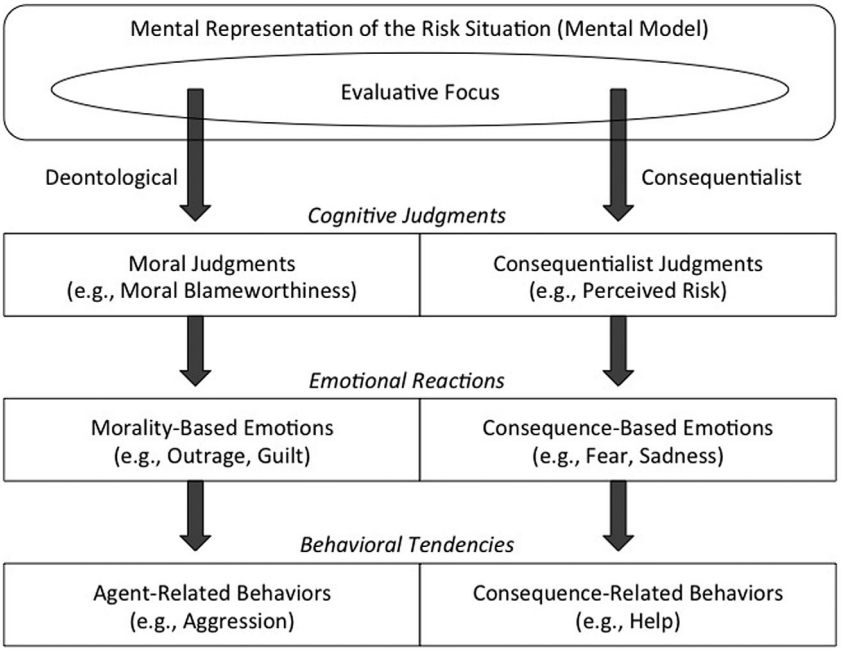

Figure 1. Dual-Process model of risk evaluation.

outrage), and agent-related behaviors (behaviors that are directed toward the causal agent, the villain, and are aimed at retaliation or punishment, e.g. boycotting the company that owns the wrecked oil tanker).

The model is a variant of a dual-process model; note, however, that the two modes proposed here differ from those postulated in most other dual process theories. Usually, dual process models distinguish analytic-deliberate from intuitive-automatic processing (Kahneman 2011; for dual process theories in the risk perception literature, see e.g. Loewenstein et al. 2001; Slovic et al. 2004). Böhm and Pfister, by contrast, distinguished consequentialist from deontological evaluation, both of which can be more or less analytical or intuitive. For example, a cognitive judgment about the riskiness of consequences can be intuitive and automatic if based on a recognition process from memory (Klein 1993); a moral judgment, on the other hand, can be deliberate and analytical if the actions to be judged constitute a moral dilemma (Knobe 2007).

Böhm and Pfister (2000) showed that the relative dominance of the two evaluative modes is influenced by the causal structure of the risk event. In their study, deontological evaluation increased with the ease with which responsibility and blame could be ascribed. They presented environmental risk scenarios. Deontological evaluations were more intense if the risk event was caused by human activity than when it was caused by nature. Such evaluations were most intense when a single human agent could be identified. Consequentialist evaluations, on the other hand, were influenced by the consequences of the event and were more intense when the consequences affected humans than when they affected nature (see also Böhm and Pfister 2005).

One of the aims of the present study was to investigate whether, in addition to a risk's causal structure, other factors would influence whether a person would focus on consequences or on morality when evaluating a risk event. We studied one potential additional factor, namely, the evaluator's social role. We assume that, like any kind of cognitive processing, risk evaluation is affected by contextual factors that influence the mental representation of a risk event and the processing of information. One potentially important factor is a person's social role, which entails higher order and long-term goals. A social role represents a stereotype, which, according to construal-level theory (Liberman and Trope 2014), will activate high-level, abstract goals, and values. For example, parents are concerned about their child's well-being, managers strive to ensure their company's prosperity, and students aim for a good education. Goals, in turn, guide information processing (Anderson 1983) and decision-making (Krantz and Kunreuther 2007), and determine which aspects of information people consider to be relevant and focus on when explaining others' behavior (Böhm and Pfister 2015b). This is not to say that people focus on their higher order goals all the time, but if such goals are activated in a situation, the goals filter how information is processed and which corresponding low-level concrete construals will emerge in particular situations. With respect to risk evaluation, we assume that people's social roles influence their evaluative focus, or, stated differently, that people in different social roles differ in their evaluative focus.

We selected three social roles that would be likely to differ in the relative importance that a person in this role would assign to consequentialist and deontological considerations: mayor, expecting parent, and environmental activist. We assumed that mayors would have a strong interest in the future economic prosperity of their community and would therefore primarily take on a consequentialist perspective.

Environmental activists, by contrast, should take a strong moral stance because they regard nature as a value in itself that should not be compromised. Expecting parents should take a middle position and may focus on both consequences and morality; we assumed that the expectation of having a child would, on the one hand, raise an interest in the prospective material and physical well-being of the child and, on the other hand, activate moral norms such as a responsibility to future generations.

These assumptions were based on the simple common sense idea that people differ in their general interests and values and that, through a combination of self-selection and learning processes, systematic differences may exist between different social roles. For example, several studies have shown that economists focus more on self-interest and profit maximization than students from other disciplines or the rest of the population (Cipriani, Lubian, and Tago 2009; Kirchgässner 2005).

The present study

The present study pursued two aims. First, we wanted to confirm the theoretical distinction between consequence-based and morality-based emotions as well as the distinction between consequence-related and agent-related behaviors. Second, we wanted to test the effects of the risk's causal structure and the evaluator's social role on the relative dominance of consequentialist vs. deontological evaluation.

We adopted the general procedure used by Böhm and Pfister (2000, 2005). We provided scenario information about fictitious environmental risk events such as an oil spill. We manipulated the risk's causal structure by varying the scenario information. We distinguished between Böhm and Pfister's (2000, 2005) three types of causal structure, which were based on the assumption that the most basic distinctions in the perceived causal structure of environmental risks are between anthropogenic and natural causation, on the one hand and between consequences for humans and those for the natural environment on the other: (1) EM-Risks (Environment-Man) are naturally caused environmental changes that pose risks for humans (e.g. volcano eruptions). (2) MEM-Risks (Man-Environment-Man) are anthropogenic human-caused environmental changes that may harm humans (e.g. deforestation). (3) ME-Risks (Man-Environment) are anthropogenic environmental changes that jeopardize the natural environment without necessarily affecting humans (e.g. agriculture leading to the extinction of rare species). Note that these distinctions constitute a continuum rather than disjoint categories. Causal structure was manipulated by providing particular information about the causation and the potential consequences of the risk event.

We expected consequentialist evaluations to be stronger when the potential consequences affected humans (causal structures EM and MEM) than when they affected nature (causal structure ME). Consequently, we expected perceived risk to be higher, consequence-based emotions (e.g. fear) to be more intense, and consequence-related behavioral tendencies (e.g. help) to be stronger for EM and MEM risks than for ME risks.

We expected deontological evaluations to be stronger for anthropogenic (causal structures ME and MEM) than for natural causation (causal structure EM). Consequently, perceived moral blameworthiness, morality-based emotions (e.g. outrage), and agent-related behavioral tendencies (e.g. boycott) were predicted to be stronger for ME and MEM risks than for EM risks.

Social role was manipulated by instructing participants to take the perspective of one of three social roles (mayor, parent, environmental activist), each described by a short text. An alternative to inducing the roles experimentally would have been to select participants who took on these roles in their real lives. However, this would have come with the disadvantage that people in these roles would have differed on an infinite number of other features that may or may not have something to do with their role as a mayor, activist, or parent so that the comparison would have been difficult to interpret. In addition, these roles are not exclusive in that, for example, a mayor or activist can also be a parent. We therefore decided to increase experimental control by inducing the roles, even if that meant that we had to ask participants to assume a role that was only hypothetical for them.

We expected consequentialist evaluation to increase from environmental activist to expecting parent to mayor. Likewise, consequentialist judgments, the intensity of consequence-based emotions such as fear, and consequence-related behavioral tendencies such as help were expected to increase from environmental activist to expecting parent to mayor. The opposite pattern across the social roles was expected for deontological evaluation. That is, deontological evaluation, and with it moral judgments, the intensity of morality-based emotions such as outrage, and agent-related behavioral tendencies such as boycotting were expected to increase from mayor to expecting parent to environmental activist.

We conducted a paper-and-pencil experiment in a student sample. Each participant was presented with two risk scenarios of the same type. After each scenario, we measured evaluative focus (consequentialist vs. deontological), cognitive judgments such as perceived risk and perceived moral blameworthiness, the intensity of several consequence-based and morality-based emotional reactions, and the tendency to perform each of a number of consequence-related and agent-related behaviors (Figure 1).

Method

Participants

Two hundred seventy undergraduate and graduate students at the University of Bremen (Germany) participated in the study. They were equally distributed across three study programs: economics, biology, and psychology. They received a monetary incentive of €7.50 for their participation. Age ranged from 19 to 54 years (M = 24.60, SD = 5.18); 56.8% were female.

Design and procedure

All materials were presented in a questionnaire. Two fictitious scenarios were presented; each of them described an environmental risk event. We will refer to the two scenarios as the island scenario and the oil scenario, respectively.

Two independent variables were manipulated. The first independent variable was social role with the three levels mayor, expecting parent, and environmental activist. Social role was manipulated by instructing participants to imagine that they were in one of these roles. We then asked them to evaluate the scenario from the perspective of this role. The instructions for the social role inductions are given in Appendix 1. The second independent variable was causal structure with three levels: ME-Risks (Man-Environment), EM-Risks (Environment-Man), and

MEM-Risks (Man-Environment-Man). Causal structure was manipulated by varying the information given about the causes and the potential consequences of the risk event. Thus, for both the island and oil scenarios, we constructed three variants that corresponded to the three types of causal structure. The scenarios are described in Appendix 2.

For each scenario, we measured the dependent variables evaluative focus, perceived risk, perceived moral blameworthiness, consequence-based emotions, morality-based emotions, consequence-related behavioral tendencies, and agent-related behavioral tendencies.

After a general introduction, the questionnaire began by inducing the social role. Then the first scenario was presented, followed by the dependent variables for the first scenario. Participants were then reminded of their social role, and the second scenario was presented, followed by the dependent variables for the second scenario. All materials were in German. Participants needed about an hour to complete the questionnaire.

Measures

Most measures were adopted from Böhm and Pfister (2005). The following dependent variables were measured:

Evaluative focus

Evaluative focus refers to whether a participant focuses on future consequences or on deontological considerations. We employed two measures of evaluative focus:

(1) A forced-choice task in which we provided two arguments for why the potential damage described in the scenario should be prevented. One argument was deontological (… because, in principle, such an event must not happen); one was consequentialist (… because the consequences would be very serious). Participants selected the argument that they considered more persuasive.
(2) A rating task in which we presented two considerations. One was deontological (… whether any human and/or animal rights are violated), and the other consequentialist (… what negative consequences for humans and/or nature might occur and how serious they would be). Participants indicated how important each consideration was to them when trying to form an opinion about the risk event. Judgments were given on a seven-point rating scale ranging from 1 (*not at all important*) to 7 (*very important*).

Cognitive judgments

Moral blameworthiness. Participants rated the extent to which they considered the situation described in the scenario to be morally blameworthy (rating scale ranging from 1 = *not at all* to 7 = *very strongly*). Blameworthiness served as an indicator of moral judgment.

Perceived overall riskiness. Participants rated how likely the situation would be to lead to harmful consequences (rating scale ranging from 1 = *very unlikely* to 7 = *very likely*). Riskiness served as an indicator of consequentialist judgment.[1]

Emotional reactions

We selected twelve specific emotions of which seven were consequence-based emotions (worry, fear, sorrow, sadness, pity, helplessness, hopelessness) and five were morality-based emotions (anger, fury, outrage, indignation, contempt). These emotions were selected on the basis of the findings from Böhm and Pfister (2005; Böhm 2003); for a theoretical account, see Pfister and Böhm (2008) and Tangney, Stuewig, and Mashek (2007). For each emotion, participants applied a seven-point rating scale ranging from 1 (*not at all*) to 7 (*very much*) to rate how intensely they felt the emotion when thinking about the risk scenario. The emotions are listed in Table 1.

Behavioral tendencies

We presented eleven behaviors. For each behavior, participants indicated the degree to which they felt inclined to perform it in the situation that was described in the scenario (seven-point rating scale ranging from 1 = *not at all* to 7 = *definitely*). The behavioral tendency items are listed in Table 2. The behaviors were selected on the basis of Böhm and Pfister (2005); in their study, these behaviors formed three behavioral types that were motivated by different emotions: help, aggression, and escape.

Manipulation checks

We measured the following variables as manipulation checks:

Ease of empathizing with the social role. Participants were asked how well they were able to relate to the induced social role. Judgments were given on rating scales ranging from 1 (*not at all*) to 7 (*very well*).

Perceived human causation. Participants rated the extent to which the situation was caused by humans; the rating scale ranged from 1 (*not at all*) to 7 (*very strongly*).

Perceived risk for humans. Participants rated how high they considered the risk for humans on a rating scale ranging from 1 = *very low risk* to 7 = *very high risk*.[2]

Perceived risk for nature. Participants rated how high they considered the risk for nature on a rating scale ranging from 1 = *very low risk* to 7 = *very high risk*.[3]

Results

We will first report the results for the manipulation checks. We will then report the results of analyses on the structure of emotions and behavioral tendencies by means of principal component analyses. These were applied to investigate whether the hypothesized taxonomy of consequence-based and morality-based emotions and that of consequence-related and agent-related behaviors was supported. We will then report the results of analyses of variance that tested the effects of social role and causal structure on evaluative focus, cognitive judgments, emotional reactions, and behavioral tendencies. Finally, we will present the results of the analyses that tested the mediating role of emotions.

Table 1. Principal component analysis of emotion ratings: rotated component loadings (varimax).

	Island scenario			Oil scenario		
Emotions	Component 1 (Morality-based)	Component 2 (Consequence-based)	Component 3 (Resignation)	Component 1 (Morality-based)	Component 2 (Consequence-based)	Component 3 (Resignation)
Outrage	**.905**	.072	.054	**.888**	.084	.104
Anger	**.877**	.161	−.063	**.868**	.098	−.023
Indignation	**.857**	.163	−.055	**.877**	.148	−.017
Fury	**.846**	.118	.097	**.853**	.136	.220
Contempt	**.815**	−.012	.190	**.742**	.051	.315
Worry	.074	**.872**	.124	.038	**.835**	−.029
Sorrow	.088	**.868**	.177	.103	**.822**	.146
Fear	.084	**.742**	.231	.114	**.658**	.273
Sadness	.195	**.729**	.239	.143	**.709**	.240
Helplessness	.023	.169	**.854**	.045	.156	**.837**
Hopelessness	.111	.194	**.826**	.177	.143	**.826**
Pity	.003	.193	**.473**	.132	.379	**.488**
Explained variance (after rotation)	31.5%	23.1%	15.4%	30.7%	21.3%	16.1%

Note: Bold font indicates the highest loading of a variable across components; for Components 1 and 2, the emotion items with bold loadings were used to compute the index of the corresponding emotion type.

Table 2. Principal component analysis of behavioral tendencies: rotated component loadings (varimax).

	Island scenario			Oil scenario		
Behaviors	Component 1 (Help)	Component 2 (Aggression)	Component 3 (Escape)	Component 1 (Help)	Component 2 (Aggression)	Component 3 (Escape)
I would help to reduce or limit potential damage.	**.857**	.116	−.077	**.816**	−.047	−.002
I would help to avert any suffering that has occurred.	**.841**	−.050	.109	**.800**	−.141	.204
I would donate to an environmental or relief organization that would take action against the situation.	**.741**	.100	.014	**.690**	.113	.033
I would sign a petition that is aimed at reducing/limiting the potential damage.	**.662**	.301	−.111	**.529**	.450	−.097
I would participate in a demonstration so that the situation or potential damage could be prevented.	**.662**	.372	−.252	**.747**	.271	−.040
I would like to pour out my heart to a friend.	.436	.235	.403	.398	.064	.544
I feel like yelling at the one who is responsible.	.161	**.878**	−.044	.085	**.871**	.196
I feel like hitting the one who is responsible.	.048	**.842**	.122	−.025	**.847**	.211
I feel like crying.	.286	.627	.268	.294	.197	.655
I feel like running away.	−.010	.259	**.799**	−.156	.121	**.797**
I would like to forget everything as soon as possible.	−.149	−.084	**.773**	−.405	.089	**.507**
Explained variance (after rotation)	29.0%	20.5%	14.4%	27.8%	16.8%	15.9%

Note: Bold font indicates which behavior items were used to compute the index of the corresponding behavior type.

Manipulation checks

Check of causal structure manipulation

The causal structure of a risk was defined by the combination of a cause with a consequence, both of which were specified in the risk scenario. The cause was varied as either anthropogenic (ME, MEM) or of natural origin (EM). The measure of perceived human causation served as a manipulation check for this distinction. The consequences of a risk were varied as affecting either humans (MEM, EM) or nature (ME). The measures of perceived risk for humans and perceived risk for nature served as manipulation checks for the consequence part of the causal structure manipulation.

Perceived human causation. A separate analysis of variance was computed for each scenario with human causation as the dependent variable and causal structure as the independent variable. The main effect of causal structure was significant for the island scenario, $F(2, 266) = 90.8$, $p < .001$, as well as for the oil scenario, $F(2, 266) = 175.8$, $p < .001$ (the island scenario means were EM = 3.1, MEM = 5.9, ME = 6.2; the oil scenario means were EM = 3.2, MEM = 6.7, ME = 6.8). A *post hoc* contrast comparing risks with natural causation vs. risks with human causation (EM vs. MEM + ME) yielded significant differences for both the island scenario, $t(266) = 13.4$, $p < .001$, and the oil scenario, $t(266) = 18.8$, $p < .001$. Thus, we concluded that with respect to causation, the causal structure of the scenarios was manipulated successfully. Scenarios that were portrayed as caused by humans were more strongly attributed to human causation than scenarios portrayed as due to a natural cause.

Perceived risk for humans and for nature. We computed two separate simple analyses of variance for each scenario with perceived risk for humans and perceived risk for nature, respectively, serving as the dependent variable, and causal structure as the independent variable. For the island scenario, there were significant effects of causal structure on perceived risk for humans, $F(2, 266) = 8.1$, $p < .001$, and perceived risk for nature, $F(2, 267) = 14.1$, $p < .001$; the respective means were EM = 3.6, MEM = 3.9, and ME = 2.6 for risk for humans and EM = 4.1, MEM = 4.8, and ME = 5.6 for risk for nature. Pairwise *post hoc* contrasts concerning risk for humans showed significant differences between the EM and ME scenarios, $t(266) = 3.02$, $p = .007$, and between the MEM and ME scenarios, $t(266) = 3.8$, $p < .001$, consistent with the manipulation. Concerning risk for nature, all contrasts showed significant differences – $t(266) = 2.5, 5.3, 2.8$, $p = .038$, $p < .001$, $p = .013$, for EM vs. MEM, EM vs. ME, and MEM vs. ME, respectively – which were also consistent with the manipulation.

For the oil scenario, however, neither risk for humans nor risk for nature was significantly affected by the scenario's causal structure. The means for risk for humans showed the expected pattern (EM = 5.0, MEM = 4.9, ME = 4.6), whereas risk for nature was basically the same for all variants of the scenario (EM = 6.3, MEM = 6.2, ME = 6.2).

In sum, the variation in the consequences as part of the causal structure manipulation was successful for the island scenario but not for the oil scenario (Figure 2). An analogous result was obtained by Böhm and Pfister (2005).[4]

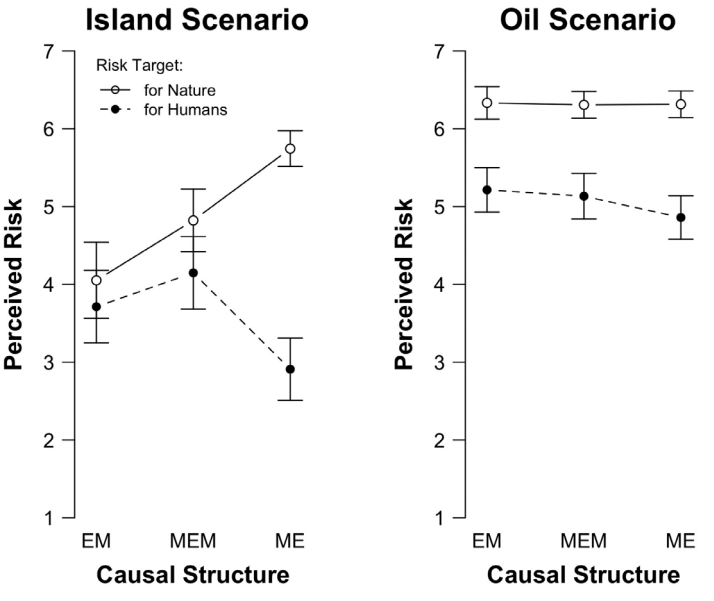

Figure 2. Manipulation check. Perceived risk for humans and for nature as a function of causal structure.
Note: Error bars indicate 95% confidence intervals.

Check for the social role manipulation

Participants indicated the degree to which they were able to relate to the social role induced by the experimental manipulation on a seven-point rating scale. For each role and scenario, the means on this item were well above the scale midpoint of 4 for the island scenario ($M = 4.4$, 4.7, and 4.6 for mayor, parent, and activist, respectively) and for the oil scenario ($M = 4.7$, 5.3, and 5.0). According to one-sample t-tests, all means were significantly greater than 4.0 (all ts(89) > 3.0, all ps < .001).

We concluded that the social role manipulation was successful because participants were able to relate to their roles to sufficient degrees.

Structural analyses

Structure of emotions

We hypothesized that emotions elicited by environmental risks could be classified as consequence-based and morality-based emotions. We analyzed the structure of the emotion ratings by applying a principal component analysis with varimax rotation. We conducted two separate analyses for the island and oil scenarios, respectively. Both analyses yielded three components, as indicated by both the Kaiser criterion and the scree plots. Table 1 shows the table of loadings. Three components explained 70.0% of the variance in the island scenario and 68.1% in the oil scenario. The solutions for the two scenarios were virtually identical. The first two components supported the distinction between morality-based and consequence-based emotions. The first component comprised morality-based emotions (outrage, anger, indignation, fury, contempt), the second consequence-based emotions (worry, sorrow, fear, sadness). The three emotions with high loadings on the third component

(helplessness, hopelessness, pity) had been conceptualized as consequence-based emotions, but they formed a separate component. We labeled it a resignation factor but excluded it from further analyses, leaving it as a topic for further research. The three components clearly replicated Böhm and Pfister's (2005) results.

For each scenario, we computed two emotion indices, one for morality-based emotions and one for consequence-based emotions. The indices were computed by averaging the emotions with the highest loadings (>.40) on the respective factor (see Table 1) for each index. The indices showed satisfactory internal consistencies (morality-based: $\alpha = .917$ and $\alpha = .909$ for the island and oil scenarios, respectively; consequence-based: $\alpha = .852$ and $\alpha = .790$ for the island and oil scenarios, respectively).

Structure of behavioral tendencies

The structure of the behavioral tendencies was explored in a manner analogous to the emotion ratings. The behavioral tendency ratings for the island and oil scenarios were analyzed with two separate principal component analyses. Both the Kaiser criterion and the scree plot suggested a three-component solution for both scenarios. The rotated loadings (varimax rotation) are shown in Table 2. Three components explained 63.9% (island scenario) and 60.6% (oil scenario) of the variance. The solutions for the two scenarios were highly similar. The first two components supported our hypothesized classification of behaviors as consequence-related and agent-related behaviors. The first component captured behaviors that focused on alleviating damage; we labeled it tendency to help. The second component summarized yelling at and hitting the responsible agent; we labeled it tendency to be aggressive. The third component (feeling like running away and wanting to forget everything) could be interpreted as tendency to escape. For each of the three components, we computed an index by averaging the behavioral tendencies with the highest loadings (>.40) on the respective factor (see Table 2). Two behavior items (pour out my heart and crying) were not included in any index because they exhibited inconsistent loading patterns in the two scenarios. The internal consistencies of the indices for help and aggression were satisfactory: Cronbach's alpha was $\alpha = .841$ (island scenario) and $\alpha = .800$ (oil scenario) for help and $\alpha = .805$ (island scenario) and $\alpha = .828$ (oil scenario) for aggression. The escape index, by contrast, was not sufficiently internally consistent (αs below .6); we excluded it from further analyses.

Effect of causal structure and social role on model variables

We will now report the results for the effects of the independent variables causal structure and social role on the components of the risk evaluation model (see Figure 1): evaluative focus (consequentialist vs. deontological), cognitive judgments (consequentialist vs. moral), emotional reactions (consequence-based vs. morality-based), and behavioral tendencies (consequence-related vs. agent-related).

With respect to the effects of causal structure, we predicted that a consequentialist evaluation would be stronger when the potential consequences affected humans (causal structures EM and MEM) than when they affected nature (causal structure ME). Deontological evaluation, by contrast, was predicted to be stronger when the risk event was caused by humans (causal structures ME and MEM) than when it was caused by natural processes (causal structure EM).

Concerning the effect of social role, we predicted that deontological evaluations would increase across the social roles from mayor to expecting parent to environmental activist. The opposite pattern was expected for consequentialist evaluations.

All subsequent results are summarized in Table 3, which corresponds to the stages in Figure 1. The general pattern of analysis was to compute a separate analysis of variance for each scenario, as well as for each dependent variable; causal structure and social role were entered as independent variables, resulting in a 3×3 design with two between-subjects factors.

Evaluative focus

Argument choice. Participants chose which of two arguments they considered more persuasive: a consequentialist or a deontological one. The choice frequencies are given in Table 4. Visual inspection of the frequencies showed that across all conditions, the consequentialist argument was chosen more frequently than the deontological one. For both scenarios, the frequencies clearly differed across the causal structure conditions: in accordance with our hypothesis, the deontological argument was selected more frequently for anthropogenic risks (MEM and ME) than for risks caused by nature (EM). Social role, by contrast, had no effect on argument choice.

We tested the effect of causal structure and social role on argument choice via logistic regression analyses. We computed separate analyses for the two scenarios. In each analysis, the dichotomous argument choice served as the dependent variable (with the deontological argument coded 0 and the consequentialist argument coded 1), and causal structure and social role were entered as predictors. Social role did not yield a significant main effect in either analysis. The effect of causal structure on argument choice, by contrast, was found to be significant (likelihood ratio test); island scenario: χ^2 (2) = 17.43, $p < .001$; oil scenario: χ^2 (2) = 16.54, $p = .001$. In both analyses, the probability of choosing the deontological argument increased significantly for MEM and ME risks compared with EM risks (the reference category). A combined analysis yielded no significant difference between the scenarios (Table 3(a-i)).

Argument rating. The second measure of evaluative focus asked participants to rate the importance of each of two arguments, which were of a consequentialist and a deontological type. Using each argument type in turn as the dependent variable and separately for each scenario, four 3×3 analyses of variance (Causal Structure × Social Role) were computed. Table 3(a-ii) shows that the only significant effect was the impact of social role on the deontological argument in the island scenario, indicating that deontological considerations (i.e. moral concerns) become more important when moving from mayor to parent to activist (Figure 3), thus partially confirming our hypothesis. Causal structure, however, had no significant impact on the importance of either argument type; we found only weak evidence that the importance of the deontological argument was affected by causal structure in the oil scenario, suggesting that moral considerations are especially important when the cause involves humans (the means were EM = 4.9, MEM = 5.5, ME = 5.3).

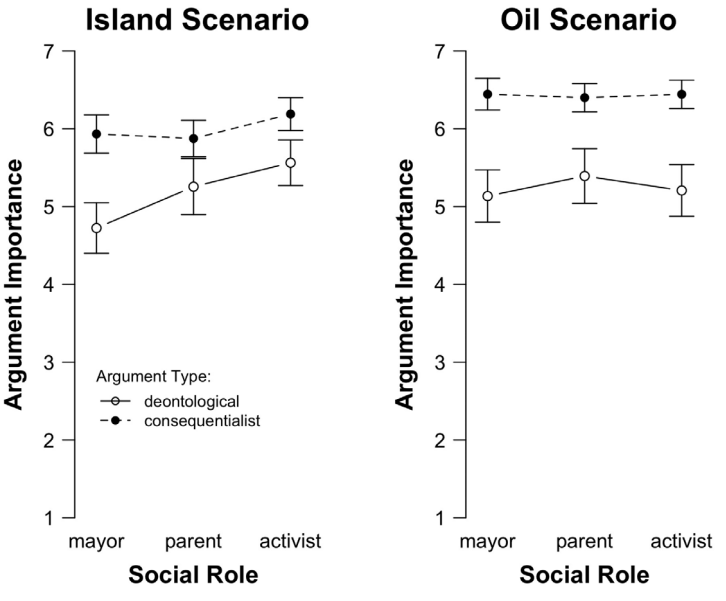

Figure 3. Evaluative focus. Importance of deontological and consequentialist arguments as a function of social role.
Note: Error bars indicate 95% confidence intervals.

Cognitive judgments

Perceived riskiness and moral blameworthiness were taken as indicators of consequentialist and moral judgments, respectively. Separately for each indicator and each scenario, a 3 × 3 analysis of variance (Causal Structure × Social Role) was computed (Table 3(b); Figure 4). For the island scenario, we found a significant effect of causal structure on moral judgments (Table 3(b)). Although the main effect of social role was not significant, a comparison contrasting the role of mayor with the roles of parent and activist yielded, as hypothesized, a significant difference: parents and activists judged the scenario as morally more blameworthy than did mayors, $t(261) = 2.2$, $p = .042$ (the means were mayor = 3.3, parent = 3.8, activist = 3.9). A significant main effect of causal structure on moral judgments was also found for the oil scenario. Concerning consequentialist judgments (i.e. perceived riskiness of the scenarios), no effects were found for either scenario.

Emotional reaction

The two indices for consequence-based and morality-based emotions as derived from the principal component analyses (see Table 1) were used as indicators of the intensity of morality-based and consequence-based emotional reactions, respectively. Separately for each indicator and each scenario, a 3 × 3 analysis of variance (Causal Structure × Social Role) was computed (Table 3(c); Figure 5, left pane). The effect of causal structure on morality-based emotions was significant for the island scenario as well as for the oil scenario (Table 3(c)). A significant main effect of causal structure on consequence-based emotions was found only for the island scenario. Social role yielded no significant effects on emotional reactions.

Table 3. Overview of statistical tests of causal structure and social role.

	Scenario			
Model Component	Island		Oil	
(a) Evaluative focus				
(i) Argument choice				
Causal structure	$\chi^2(2) = 17.4$, $p < .001$**		$\chi^2(2) = 16.5$, $p < .001$**	
Social role	n.s.		n.s.	
(ii) Argument rating				
	Deontological	Consequentialist	Deontological	Consequentialist
Causal structure	n.s.	n.s.	$F(2, 251) = 2.6$, $p = .079$	n.s.
Social role	$F(2, 251) = 6.4$, $p = .002$**	n.s.	n.s.	n.s.
(b) Cognitive judgments				
	Moral	Consequentialist	Moral	Consequentialist
Causal structure	$F(2, 261) = 49.6$, $p < .001$**	n.s.	$F(2, 260) = 121.4$, $p < .001$**	n.s.
Social role	$F(2, 261) = 2.6$, $p = .074$	n.s.	n.s.	n.s.
(c) Emotional reactions				
	Morality-based	Consequence-based	Morality-based	Consequence-based
Causal structure	$F(2, 261) = 39.9$, $p < .001$**	$F(2, 261) = 3.9$, $p = .021$*	$F(2, 261) = 48.0$, $p < .001$**	n.s.
Social role	n.s.	n.s.	n.s.	n.s.
(d) Behavioral tendencies				
	Agent-related	Consequence-related	Agent-related	Consequence-related
Causal structure	$F(2, 261) = 8.9$, $p < .001$**	n.s.	$F(2, 260) = 9.2$, $p < .001$**	n.s.
Social role	$F(2, 261) = 2.8$, $p = .064$	$F(2, 261) = 6.1$, $p = .002$**	n.s.	$F(2, 260) = 6.2$, $p = .002$**

Note: * $p < .05$, ** $p < .01$.

Table 4. Evaluative focus: Number of participants who selected the deontological or the consequentialist argument as more persuasive.

	Island scenario			Oil scenario		
Risk type						
Argument	EM	MEM	ME	EM	MEM	ME
Morally principled	7	24	27	12	34	30
Consequentialist	83	66	63	78	56	59
N	90	90	90	90	90	89
Social role						
Argument	Mayor	Parent	Activist	Mayor	Parent	Activist
Morally principled	19	21	18	25	24	27
Consequentialist	71	69	72	65	66	62
N	90	90	90	90	90	89

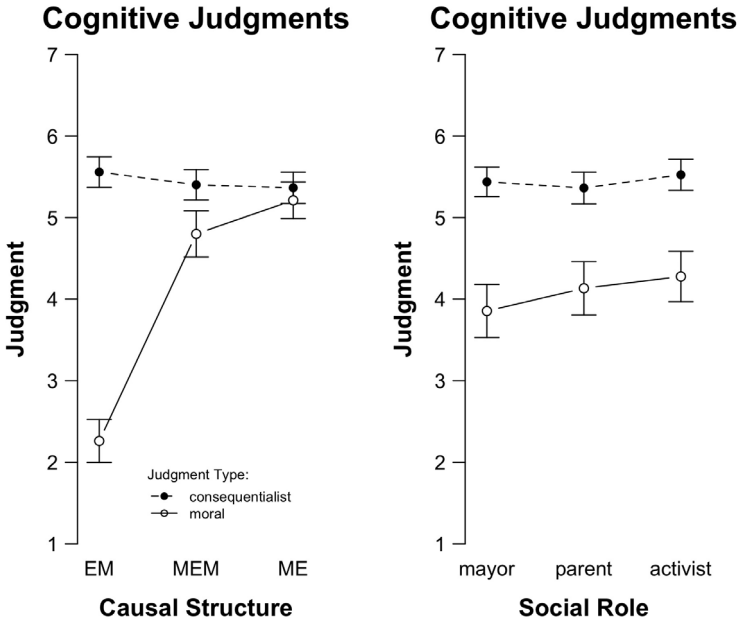

Figure 4. Cognitive judgments. Moral (blameworthiness) and consequentialist (perceived riskiness) judgments as a function of causal structure and social role (averaged across scenarios). Note: Error bars indicate 95% confidence intervals.

Behavioral tendencies

Indices for consequence-related and agent-related behavioral tendencies were derived from the principal component analysis (see Table 2), corresponding to tendencies to help those who suffer from consequences and to aggressive tendencies toward the causal agents of the risk. Again, separate 3 × 3 analyses of variance (Causal Structure × Social Role) were computed for each indicator and each scenario (Table 3(d); Figure 5, right pane; Figure 6). For the island scenario, social role had a

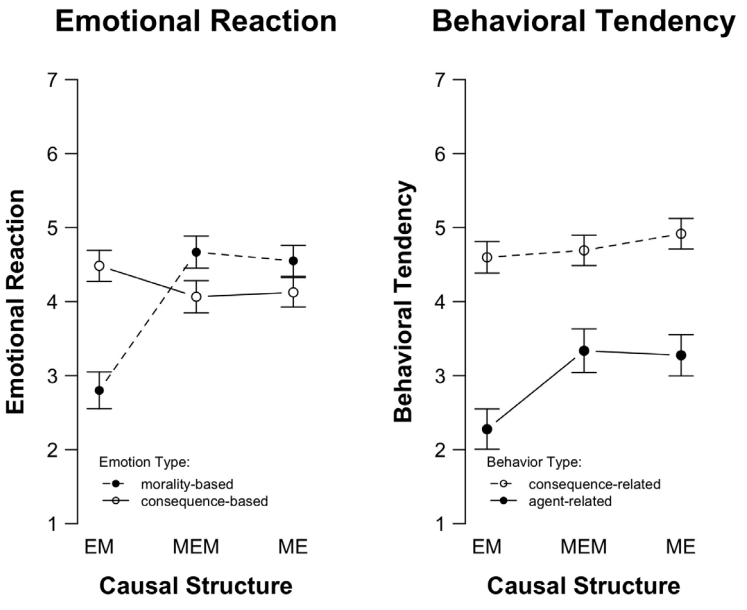

Figure 5. Emotional reactions (left) and behavioral tendencies (right) as a function of causal structure (averaged across scenarios).
Note: Error bars indicate 95% confidence intervals.

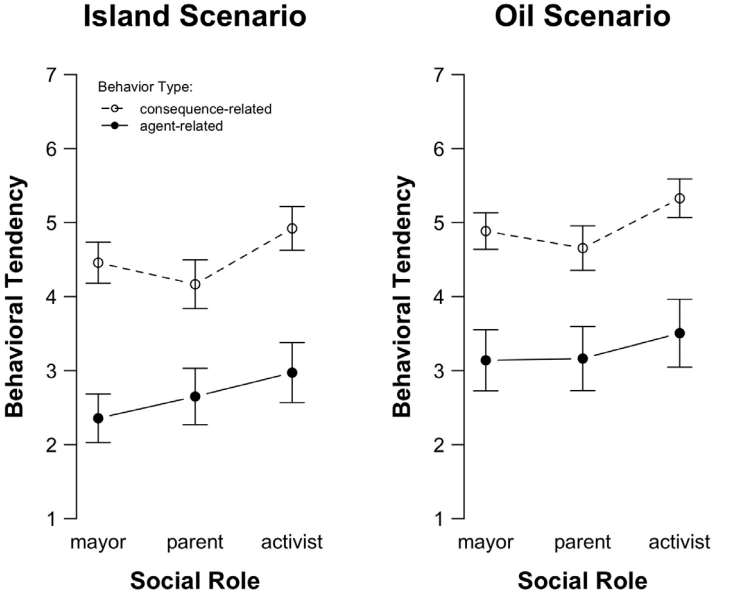

Figure 6. Behavioral tendencies as a function of social role.
Note: Error bars indicate 95% confidence intervals.

marginal effect on agent-related and a significant effect on consequence-related behaviors; causal structure significantly affected agent-related behaviors. For the oil scenario, significant effects were found for causal structure on agent-related behavior and for social role on consequence-related behavior (Table 3(d)). Specifically, participants experienced a stronger tendency to perform agent-related behaviors (aggression) when reading a scenario about an anthropogenic risk (MEM, ME) than when confronted with a risk brought about by a natural cause (EM) (Figure 5, right pane). In general, behavioral tendencies increased from the EM to the MEM and ME causal structures (the means across scenarios and behavioral types were EM = 3.4, MEM = 4.0, ME = 4.1); also, there was an increase from the mayor and parent roles to the activist social role (the means across scenarios and behavioral types were mayor = 3.7, parent = 3.7, activist = 4.2) (Figure 6).

Mediation analyses

The analyses of variance examined whether causal structure and social role individually affected each of the stages postulated in the dual process model. The assumptions of the model were actually more specific. Once the focus was directed toward either the consequences or the deontological aspects, the unfolding of a causal sequence of processes was assumed. Along the *consequentialist path*, the focus on negative consequences was expected to lead to judgments of riskiness, which were then expected to elicit various consequence-based emotions, which, in turn, were expected to trigger consequence-related behavioral tendencies such as a desire to help. Along the *deontological path*, the focus on violations of moral principles was postulated to lead to judgments of moral blame, which elicit morality-based emotions, which finally trigger a tendency to engage in agent-related behaviors such as aggressive acts. As explained in the introductory section, we did not expect that people would focus exclusively on either one of the paths; only a relative dominance of one focus over the other was expected.

Table 5. Mediation analyses testing the consequentialist and the deontological paths.

	Island scenario			Oil scenario		
	Effect	CI (95%)	Sig. Test	Effect	CI (95%)	Sig. Test
Consequentialist path						
Indirect (mediated) effect	.186	[.101, .284]	$p < .001$	.202	[.118, .300]	$p < .001$
Partial direct effect	.465	[.320, .609]	$p < .001$	.338	[.168, .507]	$p < .001$
N	266			265		
Deontological path						
Indirect (mediated) effect	.197	[.119, .287]	$p < .001$	.205	[.113, .307]	$p < .001$
Partial direct effect	.049	[-.086, .181]	$p = .424$	−.049	[-.189, .091]	$p = .490$
N	260			258		

Notes: (a) In each analysis, one of the two argument ratings (a focus on consequences or on violation of rights, respectively) served as the independent variable, one of the emotion indices (consequence-based emotions or morality-based emotions, respectively) served as the mediator, and one of the behavioral tendency indices (consequence-related behaviors/help or agent-related behaviors/aggression, respectively) served as the outcome variable. (b) The Sobel test (Sobel 1982) was used to test the significance of the mediated effect; the t-test from the multiple regression model was used to test the significance of the direct effect. Mediation analysis according to Baron and Kenny (1986) as well as the causal mediation framework according to Tingley et al. (2014) and the SEM-based approach (Rosseel 2012) were used to estimate the effects; all approaches yielded virtually identical results.

These cause-effect sequences could not be strictly tested with our data because we did not experimentally manipulate the intervening variables. What we could test with a mediation analysis was whether the regressive structure was compatible with a mediating causal structure (Baron and Kenny 1986; MacKinnon 2008). We specifically focused on the pivotal role of emotions as mediators between an evaluative focus and behavioral tendencies (Böhm 2003; Böhm and Pfister 2008). We examined each path separately: when considering the consequentialist path, we tested whether a stronger evaluative focus on negative consequences would lead to more intense consequence-based emotions and whether these in turn would trigger more pronounced tendencies to help; considering the deontological path, we tested whether a stronger focus on violations of moral rights would lead to more intense morality-based emotions and whether these would mediate the occurrence of more pronounced tendencies to behave aggressively. As measures in these analyses, we used the respective argument ratings as indicators of an evaluative focus plus the corresponding emotion indices (see Table 1) and behavioral indices (see Table 2).

Table 5 shows the results of the mediation analyses, separately for the island and the oil scenarios. The mediated effect represents the effect of a focus on behavior via the mediating role of emotions; the partial direct effect represents the effect of a focus on behavior, controlling for the mediated effect of emotions. The total effect was computed as the sum of the mediated and direct effects. With respect to the consequentialist path, we found that the mediated and direct effects were significant for the island as well as for the oil scenario. For both scenarios, the mediated effect was substantially smaller than the direct effect, suggesting that emotions do play a mediating role but are not strictly necessary for eliciting helping behavior.

With respect to the deontological path, we found a significant mediated effect of moral emotions for both the island and oil scenarios; the direct effect was nonsignificant for both scenarios. This suggests that, unlike the consequentialist path, for the deontological path, the experience of morality-based emotions was necessary to elicit the relevant behaviors; the mere focus on moral violations per se did not directly lead to agent-related behaviors unless it elicited corresponding morality-based emotions.

Discussion

Our results clearly support the distinction between consequentialist and deontological modes of information processing in environmental risk evaluations. We identified two types of emotional reactions as well as two types of behavioral tendencies that corresponded with this distinction. The distinction between consequence-based and morality-based emotions has been replicated in several studies now (Böhm 2003; Böhm and Pfister 2000, 2005; Hendrickx and Nicolaij 2004) as has the distinction between consequence-related and agent-related behaviors (Böhm and Pfister 2000, 2005). We found that consequentialist and deontological processing were influenced by features of the risk such as its causal structure and by the situational context such as the social role of the evaluator. A risk's causal structure was found to be a particularly influential factor. This again replicates the results of earlier studies (Böhm and Pfister 2000, 2005) and demonstrates that morality is an important aspect that people consider when evaluating risks (Ericson and Doyle 2003; Sjöberg 2000) and that moral considerations differ from consequentialist evaluations such as risk evaluations.

Consequentialist evaluations turned out to be generally very strong and mostly unaffected by the risk's causal structure or by the perceiver's social role. The same result was reported by Böhm and Pfister (2005) who used similar materials. It is possible that we did not find any effects on consequentialist evaluations because the two core events that we chose for the scenarios (i.e. oil pollution of the sea and the wearing away of an island's coastal rocks) were perceived to be of such high risk that there was no room for our experimental manipulations to affect consequentialist evaluations. Future research is needed to determine whether lower risk events produce different results. The presence of a ceiling effect was supported by the fact that the means of the consequentialist evaluations were generally in the upper ranges of the rating scales (Figure 4).

Most of the effects of causal structure concerned deontological evaluations (Table 3), which were more pronounced for anthropogenic risks than for risks caused by natural processes. Anthropogenic risks were evaluated as more morally blameworthy, aroused more intense morality-based emotions such as outrage, and triggered stronger tendencies to engage in agent-related behaviors such as aggression than natural risks.

The distinction between anthropogenic and natural causation seems to be a fundamental point that was already made in early risk perception research (e.g. Slovic, Kunreuther, and White 1974). A number of studies have shown that people perceive and react to anthropogenic vs. naturally caused risk events in very different ways and that this difference can be seen on the level of cognitive judgments, emotional reactions, and behaviors. For example, the same loss (e.g. loss of a herd of elks) is perceived to be more serious when it is caused by humans than by nature (Brown et al. 2005); technological (i.e. human-caused) disasters lead to more chronic stress reactions than natural disasters (Baum, Fleming, and Davidson 1983); and the strength with which people believe that humans are the cause of climate change predicts their level of support for public action (van der Linden et al. 2015). Our model extends the understanding of the difference between anthropogenic and natural risks by explicating the different psychological processes that are triggered by these two types of risks. Anthropogenic causation allows for the ascription of responsibility, which focuses anger reactions and affects behavioral intentions (Nerb and Spada 2001). Anthropogenic causation adds a moral component to the evaluative process that is absent for natural risks. This moral component changes the evaluator's evaluative mode by directing attention toward the involved actors and their actions and to the question of whether their behavior is morally adequate. The mediation analyses suggest that morality-based emotions serve as essential mediators in the transition from moral judgments to corresponding behaviors. The type of emotion that is aroused in this process plays a pivotal role in shaping behavioral reactions, which we will discuss in more detail below.

We found fewer effects of the evaluator's social role. The roles differed in the hypothesized direction with respect to the importance that the people who took on these roles ascribed to a deontological argument when asked to form an opinion about the risk event. There was a tendency, also in the hypothesized direction, of the people in the various social roles to differ in how morally blameworthy they considered the event. Social role weakly affected agent-related (aggression) and had a strong effect on consequence-related (help) behavioral tendencies (Figure 6).

In general, the role induction via instructions may have been weaker for social role than for causal structure; it may have been difficult for students to relate to the

role of a mayor or a parent, maybe more so than to the role of an environmental activist. A next step in future research might be to study people who are in these roles in their real lives – at the expense of giving up the experimental control that comes with inducing the roles rather than observing them.

The patterns of consequentialist and deontological evaluations that we found have important implications for our understanding of the evaluative process. Because the judgment of moral blameworthiness of the risk event was affected by the risk's cause but not by its consequences, this indicates that the common sense concept of morality is deontological rather than consequentialist (Baron and Spranca 1997; Bartels and Medin 2007).

Consequentialist evaluations and deontological evaluations are not antagonistic. We conceive of them as dual processes, but that does not mean that one precludes the other or that people focus strictly on either consequences or morality but not on both. Our results suggest that a consequentialist evaluation always takes place when people are faced with a risk event. It may well be the case that a certain amount of risk is a prerequisite for moral evaluations. If nothing serious can happen, there may be no ground for moral considerations. For strong moral evaluations to take place, additional conditions besides serious potential consequences then have to be met, for example, human causation in the case of environmental risk events. Conceptualizing one of the dual processes as the default and as the prevalent one and the other as intervening under certain conditions is similar to the dual system theories that have been proposed with respect to automatic and deliberative processing (Kahneman 2011).

Our model assigns a pivotal role to emotions in risk evaluations. Many other approaches that discuss the role of emotions in judgment and decision-making focus merely on general positive or negative affect (e.g. Peters et al. 2006). Our results support approaches that emphasize the importance of specific emotions such as fear or anger (Lerner and Keltner 2000, 2001) and suggest that the cognitive basis of specific emotions and thus their semantics is crucial in that different specific emotions that share the same valence (e.g. fear and outrage) have different behavioral consequences. This is in line with the basic assumptions of appraisal theories of emotion (Frijda 2006; Ortony, Clore, and Collins 1988) according to which specific emotions are aroused by specific cognitive appraisals and trigger specific behavioral tendencies. We applied this general framework to the domain of risk evaluations and specified which appraisal processes, specific emotions, and types of behavioral tendencies were relevant in the domain of environmental risks. We showed that help is associated with consequence-related emotions (e.g. fear), which in turn are associated with consequentialist judgments. Aggression, by contrast, was related to morality-based emotions (e.g. outrage) that result from moral judgments.

Different specific emotions have been shown to have different functions in guiding decisions and behavior (Pfister and Böhm 2008; Zeelenberg et al. 2008). Studying specific emotions will help improve our understanding of risk evaluations because specific emotions allow us to specify the motivational processes that link risk perception and risk behavior. Our results suggest that this link is particularly strong for morality-based emotions and associated behaviors. Hence, emotions may be a key to effective risk communication because emotions are necessary for decision-making. This may be particularly true when considering moral decisions, for example, about environmental risks such as climate change, where the public tends to be disengaged (Roeser 2012). This general lack of engagement in the climate

change issue has been attributed to a lack of emotional involvement (Weber 2006). Messages that foster emotional involvement may thus be particularly promising in risk communication efforts.

Our results showed that consequentialist evaluations are generally quite strong compared with deontological evaluations. This suggests that people may be especially susceptible to messages that emphasize negative future consequences and consequence-based emotions (e.g. fear, sadness) in accordance with prospect theory's notion of loss aversion (Kahneman and Tversky 1979). A recent study indeed showed that drawing attention to future environmental damage and asking people to anticipate the emotions that they would experience if they were to live in this future was the most effective strategy for promoting pro-environmental behavioral intentions (Böhm and Pfister 2015a). On the other hand, thinking about a distant future will likely lead to discounting processes and highly abstract construals (Frederick, Loewenstein, and O'Donoghue 2003; Liberman and Trope 2014), counteracting the motivation to act and fostering procrastination. Hence, messages that focus on proximate consequences are likely to be more effective than messages that focus on future consequences that are too distant (but see Pahl et al. 2014, for a discussion of the complex interplay between time, construal, and psychological distance).

We are reluctant to recommend emphasizing negative consequence-based emotions too much because other research has shown that dire messages about the future have the potential to backfire (Feinberg and Willer 2011); similarly, Ruiter et al. (2014) reported meta-analytic evidence that fear appeals might lead to defensive responses rather than self-protective actions. A better alternative may be to focus on positive emotions (Stern 2012). We have not discussed positive emotions in this article so far, but they can be easily incorporated into the model that we presented. Positive consequence-based emotions result from anticipating or experiencing either positive consequences or the non-occurrence of negative consequences (e.g. happiness, relief, and hope). Positive consequence-based emotions can be expected to motivate prosocial behaviors that are aimed at producing positive or preventing negative consequences (Telle and Pfister 2015). A recent study by Smith and Leiserowitz (2014) also pointed in this direction by showing that hope was strongly associated with support for climate change policies.

According to the results of our study, deontological messages that foster morality-based emotions should most easily resonate with an audience when the anthropogenic origin of the risk is emphasized and an agent who can be ascribed responsibility is specified (Böhm and Pfister 2000). The scenarios that we used in this study portrayed protagonists other than the study participants so that the relevant emotions and behaviors implied blame assignment to others. Moral outrage and aggression are quite destructive reactions, though. A more constructive communication strategy would be to emphasize the causal role and moral responsibility of the self. This arouses self-directed morality-based emotions such as guilt or regret (Böhm 2003) and should trigger behaviors such as repair, restoration, or redemption. For environmental behaviors, the relationship between guilt and repair was recently documented by Harth, Leach, and Kessler (2013). Again, a promising strategy may be to focus on positive emotions. Positive morality-based emotions (e.g. moral satisfaction and pride) result from the perception that one has lived up to a moral standard or has acted in a morally responsible way, for example, by having done a good deed. Positive morality-based emotions can be expected to give rise to more morally desirable behaviors that serve to maintain a positive self-image. A natural extension

of our model may be to include pleasant emotions and enjoyable behaviors and might possibly reflect the light side of risk perception.

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Disclosure statement

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Notes

1. In addition, we measured a number of other aspects of risk evaluation (e.g. the perceived severity of potential consequences). These other ratings produced the same results as the reported one, as did an aggregate index of all of these ratings. For the sake of brevity, we report only this rating.
2. See Note 1.
3. See Note 1.
4. Note that before answering the items on perceived risk for humans, participants were asked whether the presented scenario could have any harmful consequences for humans at all. For those participants who answered 'no' to this question, perceived risk for humans was set to zero. Likewise, the rating of perceived risk for nature was preceded by the question of whether any harmful consequences for nature could occur at all, and perceived risk for nature was set to zero for participants who responded 'no.' Excluding these participants from the analyses rather than setting their perceived risk to zero (perceived risk for humans: 60 participants for the island scenario, 8 for the oil scenario; perceived risk for nature: 27 participants for the island scenario, 1 for the oil scenario) did not substantially change our results or conclusions.

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Appendix 1.

Social role induction

Participants were asked to imagine that they were in one of three social roles. For each role, general goals and concerns associated with this role were described in order to induce a consequentialist focus for the mayor, a deontological focus for the environmental activist, and a blended focus for the expecting parent. The instructions read as follows (translated from German):

Mayor

Imagine that you are the mayor of a region where tourism is important. You make decisions about the allocation of financial resources and you issue decrees. The economic growth of the region for which you are responsible matters a great deal to you. You believe that environmental damage in your region would constitute a great economic loss.

Expecting parent

Imagine that you or your partner is expecting a child. You reflect intensely upon your upcoming responsibilities. It matters a great deal to you to raise your child in a healthy and intact natural environment so that he or she is not harmed. You believe that future generations have the right to live in unspoiled nature.

Environmental activist

Imagine that you are an environmental activist. You have been involved with Greenpeace for many years. You fight against the exploitation of nature by humans. The balance of nature matters a great deal to you. You believe that humans have no right to dominate nature.

Scenarios

The scenarios were adopted from Böhm and Pfister (2005). In the island scenario, the geographical institute in Kiel, Germany, reports that the coastal rocks of Tressnitz island are worn away. Depending on the causal structure condition, this is reported to be caused either by strong waves produced by fast private boats and yachts (anthropogenic causation in ME- and MEM-Risks) or by natural currents in the sea (natural causation in EM-Risks). Again, depending on the causal structure condition, this is predicted to lead either to the extinction of many bird species because the island's rocks provide unique conditions for these animals (consequences affect nature in ME-Risks) or to the evacuation of many people because their homes will be destroyed (consequences affect humans in EM- and MEM-Risks).

The oil scenario reports that a Danish research boat from the renowned institute for ecological research SEASEARCH discovered in the North Sea either oil barrels on the sea floor (anthropogenic causation in ME- and MEM-Risks) or natural oil resources that are located just underneath the sea floor due to a recent earthquake (natural causation in EM-Risks). A representative of the institute reports that the oil will dissipate into the sea, with devastating consequences for the ecosystem. The predicted consequences are either the deaths of many birds and marine animals (consequences affect nature in ME-Risks) or severe damages to fishing and tourism so that many people will lose their jobs and income (consequences affect humans in EM- and MEM-Risks).

For each of the two scenarios, three versions were constructed according to the three levels of causal structure.