

*What does it take to invest in protective behaviour?*

10028

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## **PREFACE**

This thesis is based on the research project called “Citizens, Environment, and Safety” which is currently conducting a series of studies on the Norwegian landscape to answer questions such as; “What is preventing action and how can we promote action?”. In this bachelor project, I have investigated possible answers to this question.

This study got its ideas through reading papers from different journals on the topic. The literature search was done through using Google Scholar and Scopus. In addition, the author cooperated with another student to find relevant literature on the topic and subtopics. Through discussions with another student and the project supervisors, the hypotheses and research question was decided. The research questions and the hypotheses were partly established ideas in the literature. However, the links between different findings that lead to the hypotheses was the idea of the authors. Some refinements of the second hypothesis were done in collaboration with the supervisors.

The survey the study is based on, was already developed by the project manager. However, some additional instruments were included by students in this project. The development of the instrument “coping appraisal” was a collaboration between the author and another student. Every additional instrument was carefully reviewed by the project manager. The creation of the survey on “Nettskjema” was a collaboration between students who participated in this project and the project manager. The process of translating the items was done in groups of students. Data collection was conducted by all participants in this bachelor project. To get approval from NSD (see appendix), the project manager sent a request. Guidance has been provided for carrying out statistical analyses in SPSS, by the project manager. In addition, choice of methods for the statistical analysis was done with help from the manager.

The thesis was written independently, but feedback and editing has been given by the supervisors. Interpretation of results was partly done with guidance from supervisors.

However, the ideas and arguments in this thesis are my own.

By having said all this, I declare that this body of work is my own.

**What is the role of “degree of worry” and “coping appraisal” in intentions for protective behaviour against floods? Testing components of the protective motivation theory.**

**Abstract**

Protection motivation theory (PMT) has become a leading theory to explain the cognitive processes for risk management. The PMT suggest that cognitive likelihood evaluations predict protective behaviour. Consequently, several studies have focused on the effect of cognition on predicting intentions for protective behaviour against floods. However, empirical findings show contrasting evidence for the link between cognitive risk perception and protective behaviour. Additionally, recent studies have shown that affect is a better predictor of protective behaviour against flooding. With this background, the first aim of the current study was to test part of the PMT model by studying if affect (degree of worry) could be a better predictor of protective behaviour, than cognitive likelihood evaluations. The second aim was to test if affect (degree of worry) act as a moderator of coping appraisal in predicting intentions for protective behaviour. This study presents the result of a survey with 293 respondents from a Norwegian population. Two hypothesis were tested using regression- and moderation analysis. The current study found affect as a significant predictor, but risk perception likelihood was not a significant predictor of intentions for protective behaviour, when including affect (degree of worry). In addition, no significant result of affect as a moderator of coping appraisal in predicting protective behaviour, was found. This suggest that affect is central in risk perception processes, and that predictors of intentions for protective behaviour have a complex relationship.

## **What is the role of “degree of worry” and “coping appraisal” in intentions for protective behaviour? Testing components of the protective motivation theory.**

Climate change has a widespread and severe impact on humanity, property and nature. Extreme weather events are causing losses of human lives, irreplaceable damages on buildings and infrastructure. The intergovernmental panel on climate change (Masson-Delmotte, 2021, s.19) show in their summary for policymakers, how global warming will cause a significant high amount of extreme weather events. Furthermore, this highlights the importance of reducing risks by implementing emergency planning activities to minimize the impacts of events like flooding. While previous studies have mostly focused on pro-environmental behaviours in connection to minimization of risk such as recycling behaviour (Li et al., 2019), the minimization of risk does also include protection behaviours that will prohibit losses of human lives and disruption of households. In this context, psychological research becomes essential in predicting what can motivate protective behaviours, and which psychological barriers prohibit behaviours. Findings in this field of psychology can give insight to policymakers and facilitate effective risk-communication strategies and disaster-management policies. In conclusion, this knowledge can affect the stakeholders involved, both private households and government institutions.

Cognitive processes in risk management has been one of the most central topics to study in the field of environmental psychology (Loewenstein et al., 2001). However, flood risk perception and flood protective behaviour are only weakly correlated (Bubeck et al., 2012; Miceli et al., 2008). In this sense, protective behaviours refer to actions that prohibit damaging consequences of flooding's and reduce the risk identified (Seebauer & Babicky, 2017). In the current study this will be studied through intentions for protective behaviour regarding private household measures. Further, risk perception has been referred to as the subjective evaluation of the likelihood of a future event, and the perceived catastrophic potential of a situation (Miceli et al., 2008). The complex process of risk perception has additionally been conceptualized to include both cognitive and affective aspects (Miceli et al., 2008). What is causing enhanced or reduced risk perceptions has been up for discussion. The perception of risk has been argued to include a cognitive, thinking component (Bubeck et al., 2018). On the other hand, Loewenstein et al. (2001) have described risk perception as primarily an emotional experience. What is underlying risk perception and its connection to protective behaviours, is an important research area to detect what is causing protection motivation.

## **Background: The influence of emotions to risk perception processes**

The original protective motivation theory has focused on the cognitive processes in risk evaluations, and not considered the possible influence of affect. Rogers original protective motivation theory builds on principles from the health-belief model where motivation for action is the result of probability and coping evaluations (Rogers, 1975). The protection motivation theory (PMT) has been a leading theory to explain the cognitive mediating process for risk management (Bubeck et al., 2018). The original theory postulates a model whereby the individual engages in two cognitive processes in decision making. This process will result in a protective or a non-protective response, depending on the evaluation of the threat and ability to cope. These constructs are divided into “threat appraisal” which refers to individuals perceived probability and perceived consequences of the threat. Furthermore, “threat appraisal” has been treated as a measurement of risk perception in empirical studies (Bubeck et al., 2012; Richert et. al., 2018). The other cognitive construct included in the PMT model is called “coping appraisal”, which refers to the individuals perceived self-efficacy and response-efficacy. Self-efficacy in this sense refers to the person’s self-perceived ability to cope, or to execute protective action, in response to a threat (Bubeck et al., 2018). In short, the original theory does not consider how emotional reactions may affect motivation for protective behaviour.

Recent studies show that the PMT model lacks validity as it does not consider affective responses in the risk perception process. As previously explained, studies applying the PMT model as a theoretical framework, have treated risk perception as an exclusively cognitive process through the concept of “threat appraisal”. Additionally, most studies on risk perception have focused on the cognitive forces that promote behaviour as mentioned by Peters et al., 2004, and described in Lechowskas (2018) review of factors included in risk perception. However, the empirical findings show that there is no direct link between “threat appraisal” in risk perception measures, and intentions for protective behaviour (Bubeck et al., 2012). These findings are also supported by a recent meta-analysis showing that only coping appraisal and negative emotions predicts preventive behaviour intentions (Bamberg et. al., 2017). Even though recent studies applying PMT have included affect as a predictor of behaviour, the construct of risk perception is still treated as one single psychological dimension including both cognitive and affective components that directly promotes behaviour (Miceli et. al., 2008; Richart et. al., 2017). In short, the findings of Bubeck et al. (2012) on the insignificant link between likelihood measures in risk perception and protective behaviour, is not considered in many recent studies.

Some studies have started to implement affective components in risk perception measures. For example, emotion-based models of risk perception have been tested in an earlier study in connection to different types of radiation (Peters et. al., 2004). Yet there is still a lack of studies on affect as the only predictor in risk perception of intentions for behaviour in relation to floods. The present study aims to investigate whether affective aspects of risk perception are better predictors for protective behaviour than cognitive likelihood judgements, as previous findings has shown. The findings by Bamberg et. al (2017) and Bubeck et. al. (2012) points to a direct link between affect and motivation for behaviour, and that cognitive aspects only have an indirect effect. This underscores the fundamental nature of emotions, which further highlights the importance of studying affect and cognition separately in predicting intentions for behaviour. Even though studies have already measured the link between behavioural intentions and emotions, there is still a need to test how these variables are linked to protective behaviour against flooding's in a Norwegian population.

The theoretical orientation whereby emotions are hypothesized as primary for motivation and subsequent behaviour could also explain what promotes protective behaviour. Among these, Slovic and Peters (2006) have highlighted the direct effect of emotions to risk management through the concept of “the affect heuristic” (Slovic & Peters, 2006). Furthermore, Lowengrip et. al. (2001) theoretical orientation in relation to risk as feelings supports this notion. They highlight the direct role of emotions in decision making processes, and the indirect role of cognitive evaluations. More specifically, a previous study on affect indicates that fear is a central emotion in relation to flooding events (Böhm, 2003). With this background, the current study will focus on how degree of worry is connected to protective action against flooding. To make it clear, “degree of worry” will be referred to as “risk perception affect”.

Additionally, feelings of worry and coping appraisal needs to be tested in a combined model in relation to protective behaviour against flooding. Coping appraisal have shown a significant direct link with behaviour (Bubeck et al., 2013), and a moderating effect on emotions in predicting behaviour (Ogunbode et al., 2019). Richart et al. (2017) has also demonstrated the complex process of coping appraisal, whereby the predictor is only significant under specific terms which suggest a need for further studies. Based on these findings emotional reactions to flooding is not just important to study in relation to behaviour, but also in connection to coping appraisal.

## **Background: The connection between coping appraisal and emotions**

As presented above, affect shows a direct link with protective behaviours. Even though positive correlations between motivation for behaviour and affect have been detected, the conceptualization of “The resilience paradox” by Ogunbode et al. (2019), gives new insight to the connection between affect, cognition and behaviour. According to their results, coping appraisal can moderate the effect of negative emotion as predictor of motivation for behaviour. More precisely, the observations in the study indicate that higher coping appraisal can decrease negative emotions and then cause diminished motivation to mitigate climate change (Ogunbode et al., 2019). The findings by Ogunbode et al. (2019) on the effects of coping appraisal on emotions, substantiate the importance of separating the cognitive and affective dimensions in risk perception measures, and test the link between affect and coping appraisal. Based on Ogunbode et al. (2019) findings there is also reason to assume that coping appraisal is conditional to degree of worry in predicting intentions for behaviour. In addition, Ogunbode et al. (2019) findings underline the significance of implementing coping appraisal and feelings of worry in the same model to test possible links between predictors, in predicting intentions for behaviour. Yet, how this relationship could influence intentions in connection to protective behaviour against flooding’s have not been tested, as Ogunbode et al. (2019) studied pro-environmental behaviour.

Other studies have shown direct effects of fear and coping appraisal in protective behaviour (Bamberg et al., 2017). However, recent researchers have not tested how the relationship between coping appraisal and affect is connected to protective behaviour against flooding. This could be the result of studies treating risk perception as likelihood evaluations (Bubeck et al., 2018), and coping appraisal and risk perception as two separate concepts without a link. Among these, Miceli et al. (2008) have argued that subjective evaluations of risk likelihood and worry should be treated as one single psychological dimension. The possible bidirectional effects between affect and coping appraisal are not considered in Miceli et al. (2008) study, since risk perception was treated as one psychological dimension. The lack of studies on this link demonstrates a gap in the risk management literature.

The reasoning behind the link between anxiety and coping appraisal is highlighted in Lerner’s and Keltner’s (2001) article. The link is explained as a result of how fear is predicted from appraisals of uncertainty and lack of situational control. In line with Lerner and Keltner (2001) findings, fear and beliefs about situational control can have bidirectional effects, and should be studied in the same model to detect how people act upon risk. If perceived control influence affective experiences of a risk, coping appraisal and degree of worry should be

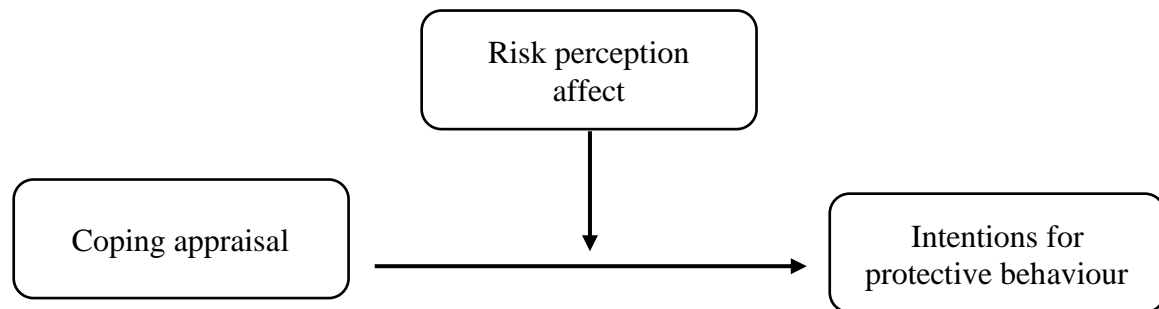
negatively correlated. The possible bidirectional effect between coping appraisal and risk perception is not included in the PMT model nor in recent studies. Even though Ogunbode et al. (2017) findings, and Lerner and Keltner's hypothesis, points in the direction of a negative correlation, it is still a need to study this link in connection to protective behaviour against floods. Therefore, the aim in the current study is to test how these variables interact and separate the cognitive and affective components in risk perception.

In addition, the present study focuses on the effect of degree of worry and does not measure general negative emotions, as Ogunbode et al. (2019) measured in their study. Earlier studies show that anger and fear can have opposite effects on the risk perception of terrorism (Lerner et al., 2003). Whereas anger promotes a more optimistic view, fear promotes a more pessimistic view. Their results indicated that emotions should be examined separately, rather than as global moods (Lerner et al., 2003). Based on the findings, this study will focus on the emotion fear, because of its relevance to flooding's (Böhm, 2003). However, it is important to note that other emotional reactions, to the same object (flooding), could influence protective behaviour.

As presented, there is a gap in the research field on what promotes protective behaviour. Empirical evidence demonstrates the significance of studying coping appraisal, degree of worry and behaviour in a combined model. The relevance of this study becomes underlined by recent studies that do not test the components of the PMT model, and findings showing weak correlation or insignificant results of cognitive likelihood evaluations as predictor for protective behaviour. Based on this, the current study will test the role of "degree of worry" for risk perception in relation to flood-related protective behaviour and focus on the effects of emotions in connection to coping appraisal to further validate the protective motivation theory. H1) Degree of worry is a better predictor for intentions for protective behaviour against flooding's than likelihood judgements. H2) Coping appraisal is conditional to risk perception affect (degree of worry) in predicting intentions for protective behaviour.



## Hypothesis model



## Method

### Respondents

A survey was deployed in spring 2022 and completed by 293 respondents across a Norwegian population. The form was posted on social media, both public on Facebook, and in private channels on messenger and slack. There were no restrictions on who could respond but it was an age limit on 18+. The survey was also posted on Facebook-groups for municipalities that had experienced flooding events. Additionally, a Facebook add was purchased.

The sample consisted of 293 respondents, participants age ranged from 18 years to 79 years, ( $M = 44.48$ ,  $SD = 16.70$ ). Among the respondents, 43% were men and 54% were women. Under 3 % preferred to not answer the question. Furthermore, 81 people (27%) had low level of education (middle school), 108 (37%) people had a bachelor degree or one-year study at university level, and 104 (36%) people had a higher degree exam at university level. The sample included respondents were 102 people (35%) self-reported that they lived in a flood-prone area and 191 (65%) did not. Furthermore, 137 people (47%) self-reported that they had never been personally affected by a flood, and 156 people (53%) had been either directly affected by a flood, indirectly effected or both.

### Procedure

The participants were asked to answer the survey through social media, and were explained the importance of contributing in the research project. A snowball effect was created, whereby people shared or send the survey onwards on their social media account. The respondents had approximately three weeks on answering the survey, and it was deployed April 2022. Through clicking on a link to “Nettskjema”, the respondents could answer and

deliver the survey. Before submitting the survey, approval from the Norwegian center for research data (NSD) was obtained (see appendix). This was necessary since the survey asked the respondents about sensitive information (children, residence etc.). As the items used was originally created in English, the survey went through translation and back-translation from English to Norwegian to ensure close semantic meaning.

## **Instruments**

The project “What promotes protective behaviour against natural hazards like flooding’s” measured different constructs connected to cognitive and affective aspects in risk perception, intention for behaviours, and other factors that could promote or prohibit behaviour. Four scales were used to test the hypothesis. Wilson et al. (2018) measure of risk perception was used, and the items were separated in affective and probability aspects of risk evaluations. Wilson et al. (2018) created a general measure to capture affective and cognitive aspects of risk perception to various hazards.

**Risk perception affect.** The first instrument constructed as “Risk perception affect” had three items connected to the emotional experience of a flooding ( $\alpha = 0.88$ ), whereby degree of anxiety, fear and worry were measured in a 5-point scale. The items were “When thinking about flooding’s, to what degree do you feel worried?”, “When thinking about flooding’s, to what degree do you feel anxiety?” and “When thinking about flooding’s, to what degree do you feel scared?”.

**Risk perception likelihood.** To test if measures on affect in risk perception is a better predictor than likelihood judgements, the current study constructed an instrument “Risk perception likelihood”. Two items from Wilson et al. (2018) risk perception measure was used ( $\alpha = .71$ ), whereby the participant was asked questions regarding likelihood evaluations using a 5-point scale. The items were “How likely is it that a flood will occur where you live?” and “Are you confident that a flood will not occur were you live?”. Both instruments have been used in other studies to measure risk perception dimensions (Wilson et al., 2018), but has not been used separately in relation to other variables as in the current study.

**Intentions for behaviour.** To measure willingness to invest in protective behaviour the current study tested the respondent’s evaluation of how likely they were to implement different preventive measures with 7 items ( $\alpha = 0.90$ ). The instrument asked the participants to indicate the likelihood of implementing preventive measures, and was based on a 5-point scale from “Very likely” to “Very unlikely”. The items were “Prepare my home for floods”,

“Consider relocation”, “Prepare an emergency plan for all household members”, “Purchase a private flood insurance”, “Coordinate with neighbours”, “Receiving more information about flood danger in my local environment” and “Move valuable items on an upper level in the house”. The measure on willingness to invest in protective behaviour was based on Seebauer and Babicky (2017), and has been used to measure intentions for behaviours in other studies.

**Coping appraisal.** Coping appraisal was measured through 3 items connected to response efficacy and self-efficacy ( $\alpha = 0.65$ ). In this study, two items from Richert and colleagues (2017) was used to measure self-efficacy. The instrument measured self-efficacy through asking how much the respondents agree with statements regarding perceived personal ability to perform protective behaviour and avoidance of negative consequences. The loadings in the items was changed, and it included a 5-point scale instead of a 6-point. The items from the instrument were “I have control over behaviour that is protective against flooding’s” and “I think I am able to avoid the consequences of floods in my household”. Additionally, to measure response efficacy it was used one item based on Crossler’s (2010). The item from Crossler was reconstructed into a question connected to protective behaviours against flooding’s: “I think the likelihood of negative consequences from flooding’s becomes less through protective behaviour”.

### **Statistical analysis**

This study includes two hypotheses. To test the first hypothesis, i.e., whether a measure of degree of worry is a better predictor for willingness to invest in behaviour than likelihood evaluations, a linear regression analysis was conducted using SPSS. The variable *willingness to invest in protective behaviour* was the dependent variable, and *likelihood evaluations in risk perception* and *affective risk perception* was treated as independent variables. The second hypothesis, i.e., if coping appraisal is conditional to the level of worry, was tested using a moderation model with conditional analysing using PROCESS (See SPSS; Hayes, 2012), with the bootstrap technique with 5.0000 samples and 95% confidence intervals adopting model 1. *Intentions for behaviour* was the dependent variable, *coping appraisal* as the independent variable and *risk perception affect* as the moderator. Analyses were conducted, using IBM © SPSS © Statistics, version 27.0.

## Results

Table 1 shows the descriptive statistics of the study variables. As shown, the variable coping appraisal has the highest mean and standard deviation,  $M = 3.70$ ,  $SD = 0.67$ . The results indicated that the average respondent had a relatively high degree of coping appraisal, however the respondents differed averagely more on this variable than the other study variables. Further, the dependent variable, intentions for behaviour had a mean and a standard deviation which pointed out that the average respondent had a score which is not extreme on either side,  $M = 2.25$ ,  $SD = 0.06$ .

Table 1 shows the correlation matrix of the study variables. As shown, a weak significant negative correlation was found between coping appraisal and behaviour,  $p = .021$ . A small correlation was found which supported a connection between the two variables. Among the study variables, risk perception affect and intentions for behaviour appeared to have the strongest correlation with a positive significant correlation, and risk perception likelihood and intentions for behaviour appeared to have a weaker and negative correlation. A weak significant correlation between coping appraisal and risk perception affect were also found, which supported a small connection between the variables.

The regression analysis showed that risk perception affect was a significant better predictor for intentions for behaviour,  $p < .001$ , than risk perception likelihood measures,  $p = .140$ , which supported hypothesis 1 in this study. Model 1 could explain 21% of the variance in the intentions for behaviour. Multicollinearity was also checked for, and there was no evidence for correlation between the variables with the correlation coefficient under .8,  $r = .36$   $p < .001$ .

The moderation analysis using Hayes Process Macro (Hayes, 2012) showed that the effect of coping appraisal on intentions for protective behaviour was not significant for low levels of risk perception affect, with an effect of  $-.07$  [CI= $-.286, .144$ ]; for average levels of risk perception affect, with an effect of  $-.08$  [CI= $-.234, .083$ ]; for high levels of risk perception affect, with an effect of  $-.08$  [CI= $-.335, .169$ ]. The effect of coping appraisal on intentions for behaviour was not significant on all levels of the moderator risk perception affect. Therefore, the results do not support hypothesis 2, whereby coping appraisal is not conditional to any levels of risk perception affect in predicting behaviour. (See figure 1).

**Table 1***Descriptive Statistics and Correlations for Study Variables (N = 293)*

Variable	<i>M</i>	<i>SD</i>	1	2	3	4
1.Coping appraisal	3.70	0.67	-			
2.Intentions behaviour	2.25	0.06	-.12*	-		
3.Risk perception likelihood	2.59	0.06	-.17**	-.23***	-	
4. Risk perception affect	1.88	0.05	-.16**	.45***	.36***	-

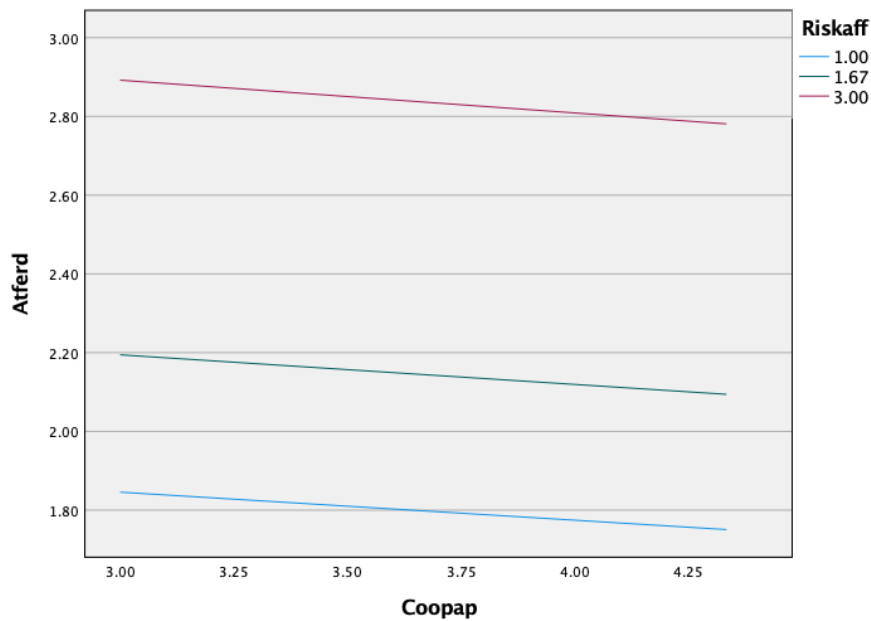
\**p* < .05, \*\**p* < .01, \*\*\**p* < .001**Table 2***Regression analysis of risk perception components as predictors for behaviour (N = 293)*

Variable	<i>b</i>	<i>SE b</i>	$\beta$ □	<i>R</i> <sup>2</sup>
Model 1				.21***
Risk perception affect	0.49***	0.07***	0.42***	
Risk perception likelihood	0.08	0.05	0.08	

\*\*\**p* < .001

**Figure 1**

*Moderation slopes for risk perception affect*



## Discussion

The current study aimed to investigate if degree of worry is a better predictor of intentions for protective behaviour, than likelihood judgements, and if risk perception affect influence coping appraisal as a predictor of intentions for behaviour, in connection to flooding events in a Norwegian population. These hypotheses aimed to test part of the components in the established PMT model. The presented findings give support to the current study hypothesis 1 that the affective component in risk perception is a better predictor of the intentions for protective behaviour against flooding than likelihood judgements, in a Norwegian population. Additionally, the regression analyses showed that risk perception likelihood was not a significant predictor of intentions for protective behaviour when risk perception affect was included in the model. The findings do not support how likelihood evaluations predicts protective behaviour. In short, the original PMT model becomes challenged by these findings since likelihood evaluation is not a significant predictor of intentions for protective behaviour when including affect, as was suggested in the protective motivation theory through the construct of “threat appraisal”. Interestingly, the results showed a negative correlation between risk perception likelihood and intentions for behaviour. Even though the correlation is weak and the correlation analysis is not unidirectional, further studies need to test how these variables are linked and if intentions for behaviour could possibly impact likelihood

evaluations in risk perception. This is important, because it could illustrate a more dynamic relationship between the components than the PMT model suggests.

The current study replicated the findings of Miceli et al. (2008) and Bamberg et al. (2017) where affect was the only predictor for flood protective behaviour. Interestingly, their results were replicated in this study where participants were recruited from a random population as it was no restriction on who could respond, in contrast to Miceli et al. (2008) study, where the participants were chosen from a flood-exposed area. In the present study, the role of living in a flood-prone area was not included as a covariate nor as a moderator. It is reasonable to assume that living in a flood-exposed area will create different mental constructs of flooding, because flood exposure could make it more mentally available. Therefore, future studies should systematically examine the role of risk perception affect in predicting intentions for protective behaviour in people living in flood-prone areas and not flood-prone.

Studies where risk perception has been operationalized as either an exclusively cognitive construct, or as one single psychological dimension including both cognitive and affective components, are also challenged by these findings. The current finding on how risk perception likelihood is not a significant predictor could explain why recent studies have found a weak link between risk perception and behaviour (Miceli et al., 2008), whereby operational definitions of risk perception might be the cause. As shown, risk perception affect has the strongest correlation with intentions for behaviour, and is the only variable with a positive correlation with intentions for protective behaviour. For this reason, future studies should include affective aspects in risk perception in studies on what promotes protective behaviour. In addition, the results demonstrated a weak negative correlation between risk perception likelihood and intentions for protective behaviour which indicate that cognitive processes in risk evaluations may be less important for protective behaviour.

However, another explanation for the weak link between likelihood evaluations and intentions for behaviour becomes evident in Richert et al. (2017) findings on the significant effect of likelihood evaluations as predictors of households' flood mitigation decisions in flood-prone areas. Richert et al. (2017) findings can point in the direction that the function of risk perception is conditional to experience. The effect of previous experience with flood on behavioural intentions are also supported by a previous study, showing that experience with flooding increases intentions for mitigation behaviour (Osberghaus, 2015). However, Osberghaus (2015) study does not test if risk evaluation routes are conditional to experiences with flooding. For this reason, further studies need to test if the relationship between intentions for protective behaviour and risk perception affect, and between risk perception

likelihood and intentions for protective behaviour, are conditional to experience with flooding. This insight can give important implications for risk management strategies, and further validation of the PMT model as it could demonstrate indirect effects which are not included in the original model nor in many recent studies.

The contrast in findings between the current study and earlier studies on risk perception, also indicate a more complex process of risk evaluations in intentions for protective behaviour against flooding than the PMT model have suggested. Even though this study has not focused on the effects of experience on risk evaluations and subsequent protective behaviour, experience may also influence the predictors. However, the PMT model do not allow for non-monotonic relationships between other variables. The contrasting findings highlight the significance of testing how variables, like experience, may have an impact on the risk perception process and subsequent behaviour.

Loewenstein et al. (2001) theoretical framework on the affective heuristic is partly supported by the findings of the current study. The findings indicated that affect in risk perception has a direct link with intentions for behaviour, and that cognitive evaluations were not a predictor. In line with the affect heuristic framework, emotions are primary for risk perception. However, this study did not test if affect is a mediator for the effects of likelihood evaluations, as the “affect-as-information” hypothesize (Loewenstein et al., 2001). An earlier meta-analysis has shown that cognitive judgements have an indirect effect on intentions for behaviour (Bamberg et al., 2017). Therefore, indirect effects could possibly explain the reason for the negative correlation between risk perception likelihood and intentions for behaviour, and why cognitive likelihood judgements is not a significant predictor for behaviour when including the affect dimension. According to Loewenstein et al. (2001), affective reactions are more rapid than cognitive evaluations, and serve as information for cognitive processing. By showing a direct effect of affect on intentions for behaviour in the current study, the hypothesis of Loewenstein et al. is supported. On the other hand, these findings do not implicate that actual behaviour is only the result of the affective reactions in risk perception. Because of the current study design, only intentions for behaviour is tested and not actual behaviour. For this reason, the current study design could also explain the insignificant result for cognitive likelihood judgements as a predictor when including affect.

The presented findings do not give support to the study hypothesis 2. The analysis showed an insignificant result of how risk perception affect acted as a moderator of the relationship between coping appraisal and protective behaviour. In other words, this study gives no evidence that coping appraisal is conditional to risk perception affect in predicting intentions



for protective behaviour against flooding. As the PMT model suggests, risk perception and coping appraisal act as to separate predictors for behaviour (Miceli et.al., 2008). These findings support this notion as no relationship between the two predictors were found in predicting intentions for behaviour. However, this study does not test other possible links between coping appraisal and risk perception affect in predicting intentions for behaviour. As Ogunbode et al. (2019) showed, coping appraisal acted as a moderator for the relationship between negative emotions and pro-environmental behaviour, and did not test risk perception affect as a moderator. In other words, the current study does not validate the PMT model completely in connection to how the predictors relate.

Ogunbode et al. (2019) demonstrated a relationship between coping appraisal and negative emotions in relation to flooding, in predicting pro-environmental behaviour. Their hypothesis was confirmed, whereby coping appraisal lead to decreased negative emotions and further reduced motivation for pro-environmental behaviour. Findings in the present study is different from but not necessarily contrasting to Ogunbode et al. (2019) results, because the same links and variables were not tested in the current statistical analysis. First, the dependent variable in the current study was intentions for protective behaviour against flooding and not pro-environmental behaviour, as in Ogunbode et al. (2019). In short, the current study and Ogunbode et al. (2019) study measured different types of behaviour which could influence the results. In this sense, protective behaviour could be counted as reactive to flooding events in contrast to pro-environmental behaviour that is proactive. Second, in the current study risk perception affect was tested as the moderator, and not coping appraisal. However, the finding that coping appraisal is a significant moderator between affect and behaviour, as shown in Ogunbode et al. (2019), and that risk perception is not a significant moderator, can foster assumptions of cognition as more primary for behaviour than affect. If so, this would challenge the “affect-as-information hypothesis” where emotions are constructed as primary to cognition. On the other side, the current study has also found that only affect has a direct effect on intentions for behaviour, and not an effect of cognitive evaluations. For this reason, these findings implicate a need further studies, because the current study do not test every link between coping appraisal and affect in relation to behaviour, nor compare which model is best suited to predict behaviour. Third, the current study tested degree of worry in risk perception affect and not negative emotional responses as in Ogunbode et al. (2019). As Lerner et al. (2004) demonstrated, different emotional reactions can lead to various outcomes, and the link between coping appraisal and affect in predicting intentions for behaviour, could be influenced by which emotional reactions are studied.

Yet, there may be another explanation; The lack of support for coping appraisal as conditional to levels of risk perception affect in predicting behaviour, may be explained by the limitation of using Hayes Process Macro as statistical procedure. Since the correlation matrix showed a negative correlation between coping appraisal and intentions for behaviour, and a positive correlation between risk perception affect and intentions for behaviour, the insignificant result of risk perception affect as a moderator may be explained by how these correlations equalizes each other in predicting intentions for behaviour. Even though Hayes Process Macro was created to detect any link on every path to the dependent level (Hayes, 2015), this insignificant result could be explained by weakness in the statistical procedure.

The statistical analysis did not find a significant result for coping appraisal as conditional to levels of risk perception affect on intentions for behaviour. However, a weak negative correlation between coping appraisal and risk perception affect were found which indicate a small link between the variables. Lerner & Keltner (2001) demonstrated that appraisals of uncertainty and lack of control is tied to feelings of worry. According to this view, a negative correlation between risk perception affect (degree of worry) and coping appraisal should be expected. The current study partly supports this hypothesis by showing a weak correlation between the two variables. However, the negative correlation does not give evidence for how this relationship is mediated, but show that some connection between coping appraisal and risk perception affect exist. As mentioned earlier, the influence of experience was not tested in the current study. For this reason, experience of flooding could explain how coping appraisals and feelings of worry were only weakly correlated. This link needs to be explored in future studies because the influence of experience could have important impact on this relationship, and further give practical implication. Another explanation for the weak correlation could be the current study operationalisation of coping appraisal. Lerner & Keltner (2001) linked feelings of fear to situational control and uncertainty. On the other hand, the current study measured perceived individual control and response efficacy.

As discussed, even though the current study did not support hypothesis 2, there is still reason to assume that predictors of protective behaviour may have bidirectional effects in predicting a protective or a non-protective response. In the current study, there is only a weak negative correlation between coping appraisal and behaviour. This is in contrast to previous studies where coping appraisal have shown a direct and indirect link to intentions for protective behaviour (Bubeck et al., 2018). An explanation for the contrasting findings is not given from the results in this study, but it indicates that coping appraisals are complex

processes that needs further studies. According to the PMT model, coping appraisal should rather have a positive correlation with behaviour (Bubeck et al., 2018), in contrast to the finding of a negative correlation in the current study. In short, the findings give support to the notion that the PMT model has limited capacity to explain the complexity of every cognitive and affective processes in risk response.

The present study support how degree of worry is an important predictor of intentions for protective behaviour against flooding. In addition, it was found that the process from risk awareness to risk response is complex, but risk perception affect does not act as a moderator of the link between coping appraisal and intentions for protective behaviour against flooding as was proposed. With these findings, part of the protective motivation theory was tested, as the construct of “threat appraisal” becomes challenged by the results the current study. However, the items in the current study do not cover the whole construct of “threat appraisal”. In addition, the PMT model was meant to demonstrate responses to various threats, and not specifically to flooding. Studies on risk responses to other threats like terror, war or pandemics, could be explained by other processes than conducted in this study. However, the current findings highlight how general models for behaviour is not adequate in explaining every process from risk awareness to risk response, and that degree of worry is an important component in risk perceptions that should be considered when predicting intentions for protective behaviour.

### **Implications and limitations**

Based on the study findings, degree of worry seems to be important for motivation to invest in behaviour that is protective against flooding. This may have implications for effective risk communication strategies. In order to protect the citizens against extreme weather events, politicians should evoke feelings of worry in households rather than increase people’s probability assessments. However, to develop substantial effective risk communication strategies, further studies on the link between affective aspects and coping appraisal for motivational aspects of protective behaviour are required. Therefore, further research needs to focus on the moderating and mediating links between affect and cognition, to develop substantial models for protective behaviour.

Some limitations in the current study could also explain the findings. The study has a limitation in using an instrument, i.e. coping appraisal, with a Cronbach’s alpha under .7. For this reason, the insignificant finding could also be caused by lack of reliability in the coping appraisal instrument. On the other side, the instruments Cronbach’s alpha is close to the .7

standard, and the items have been used in other studies to measure coping appraisal. Therefore, it was chosen to retain the items in the instrument, i.e., coping appraisal.

As mentioned in the discussion, the current study did not control for how experience nor living in a flood-prone area could influence the links between cognitive and affective components and behaviour, in the statistical analysis. This can be a limitation as it could give important implications for risk management strategies. In addition, the survey was not adapted to the respondents experience with flooding. As the current study was based on a random Norwegian population whereby there were no control of who could respond, respondents with no relation to flooding could have difficulties answering the survey. For this reason, misconceptions could occur.

To measure risk perception affect, the current study used only items in connection to “degree of worry” and did not include measures of general negative emotions associated with extreme weather events, like sadness or anger, as other studies have conducted (e.g., Ogunbode et al., 2019). Among these, Lerner & Keltner (2001) have shown that anger plays an important role in risk perception processes. This could be a limitation in the current study, as different emotions could provoke different protective behaviours. However, the aims of the study was not to map every variable that could possibly have an influence on intentions for protective behaviour. Rather, the study aimed to demonstrate the complexity of the risk perception process by highlighting the role of degree of worry in cognitive processes and for behavioural outcomes. The current results may indicate t how degree of worry is connected to behaviour, but do not function as a complete model in explaining the whole process of risk perception in predicting intentions for protective behaviour.

Another weakness to this study is the lack of ecological validity in terms of study design. Actual behaviours are not tested, and only intentions to engage in protective behaviour are studied. The practical implications of the study are then limited, because actual behaviour cannot be predicted from these findings. However, the results do to some degree give indications for reaction which could promote actual behaviour, and therefore give insight to the stakeholders involved in developing risk management policies. As supported by the current study, affect seems to be more primary for intentions to engage in private safety measures. Furthermore, this knowledge can give insight to policymakers and to risk communication strategies, in trying to secure private households against flooding. Therefore, future studies should examine actual behaviour rather than intentions for protective behaviour.

## **Conclusion**

The current study confirms previous studies that have found that degree of worry is a better predictor of intentions for protective behaviour than likelihood evaluations. The link between coping appraisal, affect and behaviour appears to be a complex process, and the impact of coping appraisal on intentions for protective behaviour is not cleared in this study. For this reason, these findings encourage future research to engage in more extensive studies in the search for indirect effects of coping appraisal to protective behaviour against flooding. Furthermore, this study highlight the limitations in using risk perception likelihood evaluations in risk perception, as a predictor of behaviour. As discussed, this points out how the construct of “threat appraisal” in the PMT model may lack validity in connection to protective behaviour against flooding, in terms of the negative correlations shown between risk perception likelihood and intentions for protective behaviour, and how affect seems more primary. In conclusion, the current study has challenged theoretical assumptions and demonstrated that predictors of intentions for protective behaviour have a complex relationship. Clarification of causations concerning the role of other emotions, and the relation of coping appraisals to affect and behaviour, are needed in further research. This knowledge is important as it can guide effective risk communication.

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# NSD NORSK SENTER FOR FORSKNINGSDATA

## NSD's assessment

### Project title

What does it take to invest in protective actions? Predictors and barriers of climate change adaptation. A focus on the effects of flooding experiences in Norway

### Reference number

564981

### Registered

22.02.2021 av Amanda Elizabeth Lai - amanda.lai@ntnu.no

### Data controller (institution responsible for the project)

Norges teknisk-naturvitenskapelige universitet / Fakultet for samfunns- og utdanningsvitenskap (SU) / Institutt for psykologi

### Project leader (academic employee/supervisor or PhD candidate)

Amanda Elizabeth Lai, amanda.lai@ntnu.no, tlf: 40758436

### Type of project

Student project, Master's thesis

### Contact information, student

Majen Christine Bjerke, majencb@stud.ntnu.no, tlf: 46854653

### Project period

01.03.2021 - 31.12.2022

### Status

10.03.2021 - Assessed anonymous

## Assessment (1)

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### 10.03.2021 - Assessed anonymous

It is our assessment that this project will not process data that can directly or indirectly identify individual persons, so long as it is carried out in accordance with what is documented in the Notification Form and attachments, dated 10.03.2021, as well as in correspondence with NSD. As a result, the project does not need an assessment from NSD.

### WHAT DO YOU NEED TO DO IF YOU ARE GOING TO PROCESS PERSONAL DATA?

If the project is changed in such a way that you will process personal data, you will need to notify this to NSD by updating the Notification Form. Wait for a reply before you start processing personal data.

END OF FOLLOW-UP

As the project will not be processing personal data, we end all further follow-up of the project.

Good luck with your project!

Contact person at NSD: Tore Andre Kjetland Fjeldsbø  
Data Protection Services for Research: +47 55 58 21 17 (press 1)