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Review

Protection Motivation Theory: A Proposed Theoretical Extension and Moving beyond Rationality—The Case of Flooding

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Abstract: Despite the significant financial and non-financial costs of household flooding, and the availability of products that can reduce the risk or impact of flooding, relatively few consumers choose to adopt these products. To help explain this, we combine the existing theoretical literature with evidence from 20 one-to-one discussions and three workshops with key stakeholders, as well as five round tables, to draw practical evidence of actual responses to flood risk. This analysis leads us to propose an extension to Protection Motivation Theory (PMT), which more accurately captures the decision-making process of consumers by highlighting the role of 'ownership appraisal'. We then assess the extent to which behavioral biases impact on this revised framework. By highlighting the interaction with an augmented model of PMT and behavioral biases, the paper sheds light on potential reasons behind the fact that consumers are unlikely to adopt property-level flood resilience measures and identifies strategies to increase flood protection. The Augmented PMT suggests that policymakers might focus on increasing the Ownership Appraisal element, both directly and by targeting the creation of more supportive social norms. The work presented here opens up a wide range of areas for future research in the field.

Keywords: flooding; protection motivation theory; property flood resilience; communication; risk

1. Introduction

The financial, emotional, and psychological impacts of household flooding are well documented [1,2]. To some extent, these costs can be avoided, or at least reduced, where properties are constructed or adapted to be more resistant (products that can reduce the likelihood of flood water entering the home) or resilient (products that can reduce the impact when flood water does enter the home) to flooding [3]. Given the extremely high costs of flooding, under a rational expectations model of human behavior, one would assume that people would need little encouragement to undertake these actions. However, cross-national research has demonstrated that people do not tend to do this [4–10]. Existing research typically attempts to explain the reasons underpinning this behavior through Protection Motivation Theory (PMT), a model used to understand consumer choices in settings including health and disaster response.

The PMT relies on the principle that the decision about whether to invest in property-level protection measures has a number of distinctive features. First, it is characterized by uncertainty and threat, in that floods are low probability/high risk events, where the likelihood of occurrence and the

resulting impacts are difficult to predict [11]. Second, the costs of floods are potentially very high, including intangible and indirect costs which are difficult to calculate [12,13]. Third, to be effective, resistance and resilience measures tend to need to be installed as a package. This can mean that, when considered as part of a modification, rather than restoration following a flood, they can be expensive. Their installation can also involve significant disruption [14]. These features make decisions in this area relatively specific and make it difficult to generalize from other areas in which people make consumer choices. Due to this, researchers have developed models of decision making which attempt to capture how people engage with decisions in the context of threats. PMT is a framework which has been widely used to predict a range of behaviors. For example, with reference to health behaviors, responses to natural disasters, and behavior towards online security [15–19]. It aims to capture the main cognitive processes that lead to a 'protection motivation', that is, a decision to invest in protection against a specific threat. Figure 1 illustrates the main elements of the framework as the theory stands at the moment.

PMT consists of two stages. The first, threat appraisal, relates to the perceived risk of the threat. It is composed of two elements: perceived vulnerability (how likely is the threat to occur?); and perceived severity (how bad will the effects of the threat be?). In this respect, it is encouraging that studies have found positive links between people's knowledge of the future frequency and impact of floods and their likelihood of investing in resilient repairs [20–22]. However, while appreciation of risk is certainly a prerequisite for taking action, other studies, including those of communities affected by flooding have shown that, even where consumers are aware of the likelihood and impact of flooding, the likelihood of them undertaking action to protect their properties is relatively low [4,23].

This weak link can be explained in PMT by the existence of a crucial second stage in decision making: coping appraisal. Coping appraisal is made up of three elements: response efficacy (how effective will a response be?), self-efficacy (how able am I to respond?), and response cost (how costly will a response be?). In [24], extended considerations for coping appraisal are presented. In practical terms, this means that people not only need to feel at risk, but also feel like they can do something about that risk. Research has shown that, among people with low coping appraisal, a high threat appraisal can translate into 'non-protective' behaviors such as denial or avoidance [25]. Indeed, some research focusing on coping appraisal has found this to be a serious hurdle to people taking up protection measures [4,25,26] and some studies have demonstrated a lack of confidence from households in choosing the best way to protect their home, and a lack of trust in the measures themselves [27].

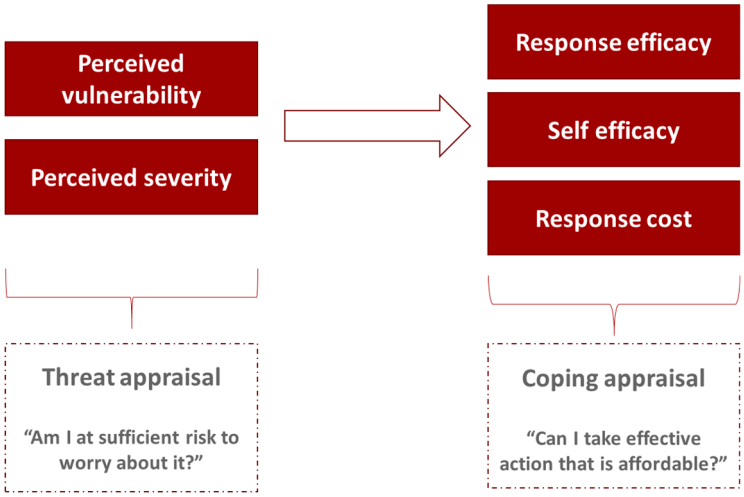


Figure 1. An illustration of Protection Motivation Theory.

The PMT framework can also be used to identify potential policy action that could improve the take up of resistance and resilience measures. In particular, the implications of PMT lead policymakers to consider the role of better communication in prompting households to take action to protect their properties. In particular, it suggests that communicating flood risks and impacts and the

fact that products are available to mitigate these, could be effective in driving household behavior (Figure 2). This is because, it implies that, where consumers do not understand the risks or impacts of flooding, simple communication techniques could be used to improve both the understanding of risk and people's confidence in taking action. For example, the framework points to the idea that communication on the relative efficacy of various products/approaches and the use of subsidies to lower the costs of action would be effective in increasing the likelihood of consumers taking action to protect their properties from flooding. It is clear that many policy responses are currently based on these principles [3].



Figure 2. Applying Protection Motivation Theory to flooding communications.

In practice, however, this form of decision-making process has been found to be an inadequate explanation of both consumer decision making and policy responses with regards to decisions over whether people protect their properties against flooding. For example, despite significant investment in improving the availability of information about the flood risk associated with properties across the UK, and the availability of generous grants for flooded properties to pay for resilience measures, the take up of the measures is still low [13,28,29].

The aim of this study is to develop a more comprehensive framework, the Augmented PMT, that can be used to explain the current poor take up of property level flood resilience measures and the relative ineffectiveness of policy to incentivize such action. Our focus is on the actions and motivations of owner-occupiers, rather than those in rented accommodation (whose motivations and behaviors may well be different). Previous studies have shown that the perception of housing related security and insecurity differs between homeowners and tenants [20,30]. Burningham et al. [30] used logistic regression analysis to explore which factors had the greatest influence on awareness that their property was in a flood risk area, where awareness was treated as a dichotomous dependent variable. The results showed that homeowners are twice as aware as tenants [30]. The main contribution of this augmented approach is to explicitly include the extent to which owner-occupying household believe it is their responsibility to act. Alongside this, there are three further objectives for this paper:

- To explore theories of decision making which question the foundations of the rational expectations model and draw on insights from psychology and behavioral economics to explain behavior [31];
- To identify the main ways in which decisions about flood protection depart from the rational expectations model of consumer behavior and how these can be applied to the Augmented PMT; and
- To interpret findings from of these elements within the context of flood risk management and the uptake of property level flood protection measures.

We believe that this research will provide a significant step forward in understanding regarding why householders typically do not act to improve their property level flood resilience and help to inform future research and government policy development.

2. Methodology

Data Collection and Framework Development

A comprehensive literature review was carried out to identify the key reasons driving consumer decision making with regard to households' decisions over whether or not to protect their individual properties against flooding. The literature review included scientific papers as well as government evidence on resilience and resistance uptake. The findings from the literature review were consolidated via a set of consultation activities including one-to-one, face-to-face interviews, round table discussions, and workshops. The face to face interviews (a total of 20) were a mixture of semi-structured interviews, open discussions, and brainstorming sessions with key stakeholders (including policymakers, academics, professionals from sectors including flood repair, financial services, and consumer protection and those supporting victims of flooding) looking to identify drivers in addition to those already highlighted by the literature review. The face to face interview approach (i.e., semi-structure interview, open discussion, and/or brainstorming) was selected based on stakeholder availability. Groups of stakeholders with mixed participants from all the professional sectors considered, including policymakers and academics, contributed to the open discussions and brainstorming sessions. Individuals unable to attend these sessions were contacted at a later stage to gather ancillary information via a semi-structured interview approach. The round table discussions (a total of five) included flood preparedness experts, representatives from key industry sectors, people who have been flooded (and their representatives), parliamentarians, policymakers, and academics focused on flood response and behavioral psychology. They were aimed at drawing evidence from a wide range of sources, including those with first-hand experience of the issues and testing and validating emerging findings. Each round table discussion had a maximum of 15 participants, Matthew Oakley (WPI Economics, Director) was always present. The workshops (a total of three) were used to communicate the combined findings of the literature review, interviews, and round table discussions and an opportunity to identify further factors.

The collective findings from the data collection phase were used to inform and develop the Augmented PMT, a conceptual framework based on the PMT and including the extent to which households believe it is their responsibility to act. Results were used to identify areas in which future work should focus to test relatively simple ways in which the take up of individual property level flood resistance and resilience measures could be increased.

3. Results

3.1. Identifying Key Decision Drivers

Results from the literature review, round table discussions, and workshops highlighted that there are two main factors that influence the uptake of property level flood protection measures: (i) ownership of action and (ii) systems of thought. Ownership of action relates to the individual or organization identified as in charge of taking action to address a particular issue [32]. Regardless of whether individuals feel they are at risk and believe that they could afford to take effective action, a significant body of research has highlighted that people in flood risk areas sometimes do not think it is their responsibility to invest in such measures [7,32]. It is often the case that households at risk of flooding believe that a combination of central and local government should be responsible for the protection of their property from flooding [29,33], or that they will be compensated in the event of a flood so do not need to take action [34]. In part, it could be argued that this is a result of the self-efficacy element of the coping appraisal; if consumers felt that the government was best placed to respond or compensate them, and that their own action would be ineffective, this would be the case. However, this goes beyond low self-efficacy as the literature suggests that consumers believe it is government that should respond, rather than the government being best placed to.

Systems of thought refers to the thought mechanisms driving the individual's decision [31]. Over recent decades, psychological theories have demonstrated that people's behavior departs from rational cost–benefit theories assumptions in numerous ways. These theories argue that instead of

rational cost–benefit analyses, decision-making processes are characterized by systematic and predictable 'biases' [31]. As well as explaining why consumers do not respond as one might expect in any given circumstance, these biases also significantly complicate policy responses.

These biases arise because people have two 'systems' of thought; one based on intuition (System 1) and one based on deliberation (System 2) [31]. Table 1 summarizes the characteristics of each system.

Table 1. Characteristics of System 1 and System 2 thinking [27].

System 1	System 2
Fast	Slow
Automatic	Controlled
Effortless	Effortful
Associative	Rule-governed
Emotional	Neutral

These systems operate simultaneously, with most of our choices requiring input from both systems. System 1 operates with no effort and is therefore present in all of our thinking. It is guided by perceptions, emotional reactions, and heuristics (rules of thumb) which we develop through experience. System 2 on the other hand is effortful, requires that we pay attention to something and can be interrupted when attention is drawn away. In practice, few decisions involve full engagement of System 2 and, in fact, we often rely on System 1 as a short cut in complex decisions.

System 1 thinking can work well for decisions in which the relationship between action and outcome is clear, and in which experience is a meaningful guide for the future. However, because of the systematic biases inherent within this type of intuitive thinking [31], System 1 thinking is likely to work less well, in contexts like flood preparedness. Based on the outcomes of the literature review, face-to-face interviews, workshops, and roundtables, the biases highlighted below were identified as the most relevant when thinking about decisions relating to flood risk.

3.1.1. Availability Bias

As it is intuitive and immediate, System 1 thinking does not weigh up all information equally but heavily weights information which is, in psychological terms, 'available'. Information is available to the mind when it is easily recalled [35]. This has significant implications for the way that people perceive risk: evidence suggests that the risks of dangers that come easily to mind, such as shark attacks, are widely overestimated, and those which are less clear are underestimated [36]. How easily things come to mind can be influenced by their salience in popular culture, e.g., plane crashes, or through the media, e.g., natural disasters, such as floods [31].

The availability bias means that recent experience is also an important determinant of how likely people perceive events to be: if someone has recently experienced a flood, one is more likely to take the prospect of one occurring again more seriously than someone who lives in a high-risk area but has not recently experienced a flood [4,37]. However, the effect of experience seems to fade over time, as the experience becomes less 'available' to people's minds [38,39]. The availability bias has been shown to affect decision making about insurance in the context of natural disasters. In the aftermath of such a disaster people are more likely to take up insurance policies [40]. Furthermore, people who know someone who has been the victim of a flood are more likely to buy flood insurance, regardless of their actual flood risk [36].

3.1.2. Optimism Bias

Related to availability bias is the tendency for people to think they are more likely to experience positive events and are less at risk of experiencing negative events than most other people. Research has shown, for example, that smokers tend to believe they are less at risk of lung cancer than other smokers [41] and that people tend to believe they are less at risk of crime than other people [42].

Optimism bias seems to be countered by experience and availability somewhat, with research showing that optimism bias is lower in communities that recently experienced a natural disaster [43]. In terms of flood risks, there is some research that people display optimism bias when assessing their own risk. For example, the Environment Agency has reported that even in areas in which nearly half the population are aware of local flood risks, only 7% felt their own property was at risk [1].

3.1.3. Myopia

Myopia refers to the tendency to focus on short time horizons when making decisions about costs and benefits. There is much experimental evidence demonstrating that people will choose a smaller benefit soon, rather than having to wait longer for a large one [44]. Research has also shown that these decisions are characterized by hyperbolic discounting, in which this effect is stronger the more immediate the benefit and weaker the longer the delay [45]. Therefore, while people tend to prefer $100 today to $110 tomorrow, they will prefer $110 in 31 days over $100 in 30 days [45].

Together myopia and hyperbolic discounting mean that the timescale over which we intuitively make plans is short-term and is often shorter than the time needed to see the long-run benefit of different kinds of investments. This effect has been proposed as an explanation, for example, of why people run up high credit card debts on high interest rates, while simultaneously investing in long-term retirement plans with lower rates—they are exhibiting different discount rates: impatience in the short term and patience in the long term [46]. Similarly, research on the way in which flood risk is presented has found that describing it in terms of a return period for example "a one in 100 year risk" leads to a lower risk perception than presenting the same risk as there being a 26% chance of a flood in the next 30 years [47].

3.1.4. Loss Aversion

This refers to the tendency for people to place more value in losses than in gains and therefore to seek to avoid losses. In decisions made in conditions of uncertainty, loss aversion has been shown to mean that people will reject risky choices that could lead to a loss [48]. Experimental research has found that people seem to value losses at twice the amount of gains: people will commonly reject a 50/50 gamble in which they may lose $20, unless the amount they could win is at least $40 [48]. Loss aversion has been used by behavioral economists to explain the endowment effect, in which people overvalue items they own, in relation to their market value. In other words, people tend to value negatively the process of losing something more than they value positively the process of acquiring even the same thing [48]. Combined with myopia, loss aversion can lead to people avoiding short-term losses that lead to long-term gains, even if the losses will eventually be worth it. A particular example of this is that it has been argued that the usual framing of insurance may discourage take-up because it comprises a short-term loss (the premiums paid) traded for an uncertain longer-term gain from coverage [49]. The gain from flood prevention and resilience measures is similarly uncertain, whereas the cost is clear, so this seems likely to be an issue here as well.

3.1.5. Emotions

The emotional content of certain decisions is something that behavioral research has emphasized. The 'affect heuristic' is where people substitute the question 'what do I feel about it?' for the more difficult question 'what do I think about it?' As such, the affect heuristic, like other such rules of thumb, is a way that System 1 thinking attempts to simplify complex mental processes. Research has demonstrated that people tend to ascribe large benefits and low risks to things they feel favorable towards, and low benefits and high risks to things they feel negative about [4,50,51].

The role of emotion in the way that people think about flood risk has become an important part of the literature: fear of flooding has been found to be a leading driver of threat appraisal [4,51,52]. Harries [53,33] argues that the emotional effects of thinking about flooding are crucial in understanding people's behavior. He argues that people want to think of their home as a place of security, of nature as something benevolent and of the state as something that can protect people.

The implication that individuals must purchase flood protection contradicts these three beliefs and therefore people tend to avoid such decisions. In contrast, other work suggests that when people find being well prepared for flooding to be a 'personally important' behavior, they are more likely to implement flood defense measures [34].

A further aspect of emotional engagement in a subject is its relation to wider social norms. Social norms are not emotions bias itself, but play a key role in decision making. Social norms also play a role for action and inaction in affecting regret [54]; for negative outcomes resulting from decisions taken by independent individuals, action is regretted more than inaction when social norms are for inaction. Harries [29,33] has suggested that social stigma could play a role in people not taking up flood protection measures, if no one else in a flood-risk community has done so. Similarly, in a study of flood insurance in Australia, take-up of insurance was not correlated to risk perception but to whether or not there was a social norm in favor of take-up [55]. Given the significance of both person emotions and social norms, we consider the impacts of both separately in what follows.

3.1.6. Complexity

From the above we can see that loss aversion and the emotional impact of decisions can lead to inertia. Complexity is another cause of the so-called 'status quo bias'. When decisions are complex, people are more likely to procrastinate [56]. One element of complexity is the number of choices that are available: experiments have shown that the more choices people have, the less likely they are to make a decision [57]. Additionally, this effect has also been seen in real-life situations, for example enrolment in US pensions is higher when employees are given fewer options to choose from, while switching in Swiss health insurance plans is lower the more options there are on the market [58,59]. As mentioned above, there is evidence that people feel unsure of how to choose flood resistance and resilience measures, and there is a lack of trust in the products themselves, both of which indicate complexity in the decision-making process.

3.2. Augmented Protection Motivation Theory

The Augmented PMT incorporates the key decision drivers described in Section 3.1. Figure 3 outlines the extension of the current PMT to include "*Ownership Appraisal*" alongside *Threat* and *Coping* appraisal. Even with this added stage of appraisal, this model would suggest that communication could have a strong role to play in supporting the take up of property flood resilience measures. For example, it could help consumers to understand that it is, at least in part, their responsibility to protect their homes. Without considering any further inputs and based on Figure 3, the combined effect of threat, ownership, and coping appraisal is what leads to action.

This means that communication of risk, costs, possible actions, and the need for action could have a significant impact on the likelihood of consumer action. However, in practice, the simplest articulation of this model is inadequate to explain consumer behavior with regards to protection against household flooding. The key challenge is that the basic parameters of this model expect people to act rationally: they weigh up the risks and then act if they believe action will be effective. It is therefore necessary to include the systems of thought component and associated biases.

These biases impact the decision-making process in different ways. Figure 4 illustrates the stages of our Augmented PMT at which they are most relevant.

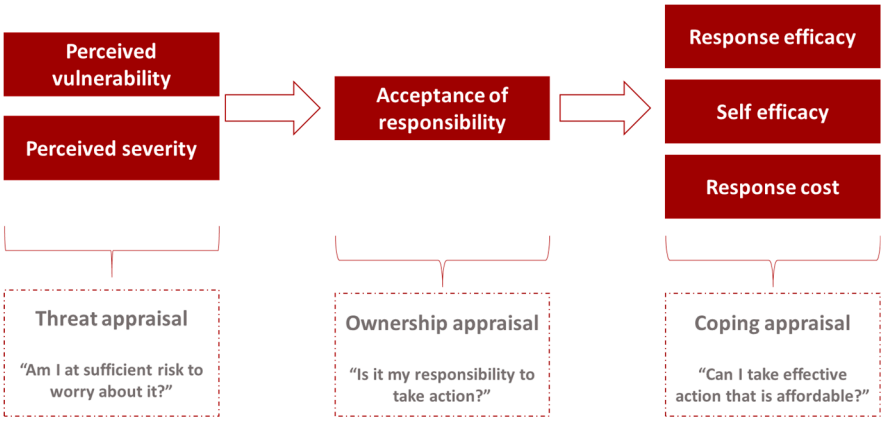


Figure 3. Proposed Augmented Protection Motivation Theory.

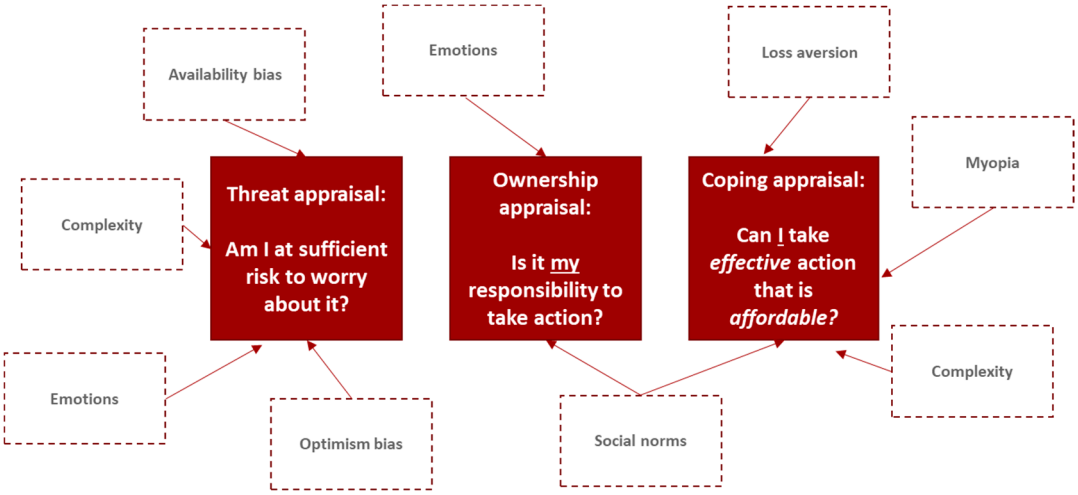


Figure 4. Augmented Protection Motivation Theory (PMT) with behavioural biases. Note that "Social norms" is not classed as biases. However, this factor has been included in the augmented PMT given their significance in the decision-making process.

4. Discussion

This research reviewed the standard framework, PMT, for considering consumer decision making around action to protect themselves from natural hazards and, specifically, adopting property flood resilience measures. We focused on owner-occupying households, rather than those in rented accommodation, whose motivations and behaviors may well be different [20,30]. This consideration is important when extrapolating the framework to tenants. Grothmann and Reusswig (2006) stated that a different response between homeowners and tenants is to be expected as owners have more than tenants to lose because of floods and they are more likely to perceive the risks from flooding as greater, they have and perceive more opportunity to take independent action [20]. Based on experiences on the ground and a wide range of evidence, we found that the PMT framework is lacking on two fronts. First, it does not explicitly consider the extent to which individuals believe it is their responsibility to take action (a factor which has been found to have a significant impact on the likelihood of households adopting flood resilience measures) and secondly too little attention has typically been paid to the biases inherent in consumer decision making and how these affect the implications of PMT. To tackle this, we proposed an extension to the standard PMT framework to encompass the extent to which individuals feel it should be their responsibility to take action. The research then considers how a range of behavioral biases impact on the Augmented PMT and consumer decision making regarding property flood resilience.

The need to consider these areas is clear (Table 2). For example:

- A range of evidence has shown that households' propensity to act rests on whether or not they believe that it should be their responsibility to do so.
- Availability bias and optimism bias can influence an individual's threat appraisal by changing the way that they consider risk and evaluate their need for resistance or resilience products.
- A recent experience of flooding, or a prominence of flooding in the news, can create a perception of a relatively high risk of flooding in the future. The reverse is true of reduced salience of flooding.
- Optimism bias can also contribute to a perception of a relatively low risk of flooding. The influence of emotions may well stop people from engaging with the decision at all, while the complexity of thinking about risk may have a similar effect.
- Complexity is also important in the coping appraisal stage. If people feel that a choice is too difficult, they may opt to avoid taking a decision at all.
- Given that flood resistance and resilience measures require an up-front investment for an uncertain return (i.e., avoiding damage in a hypothetical future flood), loss aversion and myopia may lead to people deciding against investing in such measures.

These, and other factors (Table 2), are therefore key and need to be actively considered within the Augmented PMT.

Doing so clearly makes policy responses more complex. For example, the addition of Ownership Appraisal raises an important question about how the Government can take action. For instance, does government's investment in flood risk management schemes, reduce Ownership Appraisal and the likelihood that individual households will see that they also have to take action in reducing their flood risk.

Further, when considering how communication could be used to promote the take up of flood resistance and resilience measures, it is apparent that simply providing information is unlikely to be an effective tool in increasing take up. In fact, communication could even have confounding impacts. For example, communication targeted at increasing knowledge of flood risk and the impacts of flooding could boost people's appraisal of the threat, but may reduce the likelihood of action because of their emotional desire to see their home as a place of safety. Equally, providing consumers with more detailed information about the types of products and packages of protection that might be available, could increase complexity and, in turn, reduce the likelihood of action.

In place of trying to increase understanding of risk, the Augmented PMT suggests that policymakers might instead focus on increasing the Ownership Appraisal element, both directly and by targeting the creation of more supportive social norms. There are various routes for doing this that could be explored. For example, previous work [3,60] has highlighted the potential role of flood performance certificates, similar to building energy ratings. These could inform those purchasing or renting properties of the flood risk associated with a property; the range of property level measures that could be adopted to reduce flood risk; and whether these have been taken on. This could directly increase Ownership Appraisal by making it clear which of the actions the householder has and has not taken. The impact could be reinforced by messaging on the certificates which attempts to show that resilience action is (or will be) the social norm. More generally, communications from central and local government and other parties that support flood recovery could be designed to build social norms around households ultimately being (at least in part) responsible for the protection of their properties. Here, the route of communication is likely to be important, with communications from different organizations likely to have differential impacts because of the extent to which they are 'trusted voices' [60]. To explore this, the use of advisors trusted by the community, such as the Fire and Rescue Service could be used to provide resistance and resilience advice to householders in a similar manner to the way they do for fire protection.

These are only a few potential routes through which Ownership Appraisal might be targeted directly and through the creation of social norms. Understanding which of these, and others, might be most successful will require further research on the exact routes through which a household's level of Ownership Appraisal is determined and how it might be influenced.

Alongside this, our Augmented PMT demonstrates that there are already gaps in the understanding of what motivates people to respond to the risk of flooding. This is important both because each of the elements of the Augmented PMT will feedback into each other and because the range of behavioral biases that impact on consumers at each stage of our Augmented PMT makes understanding, predicting, and influencing behavior in this area difficult. In addition, there are very few studies that apply these principles to flooding and the uptake of property-level flood resistance and resilience measures at any significant scale. Most that do exist focus on small-scale trials or qualitative research, meaning that larger-scale quantitative analysis of the statistical relationships between household's flood-response behaviors and the elements of the Augmented PMT would provide significant added value. One study that has taken the first steps in trying to understand the statistical relationship between behavioral motivations and flood preparedness [34] also highlights the importance of further research in this area. The work by Crossler and Bélanger [61] highlights a wide range of statistical analysis that could be suitable within the context of the Augmented PMT. These include multivariate analysis (principal component analysis), data dimensionality analysis, eigenvalues bootstrapping, reliability analysis and structural models, amongst others. The analyses presented [61] were used to tests the effectiveness of PMT to explain a measure for collectively capturing several individual PC security practices and would be transferable to test specific aspects of the PMT framework presented in this study. Specifically, it will enable the statistical comparison of different individuals with regard to their overall performance on a set of security practices to manage flood risk.

Table 2. Compilation of key messages identified in this research (via the comprehensive literature review, face to face interviews, round tables, and workshops) and used to develop the Augmented Protection Motivation Theory.

Key Message
• People that have recently experienced a flood are more likely to take the prospect of one occurring again more seriously that someone in a high-risk are that has not experienced the flood.
• The effect of experiencing a flood fades with time.
• In the aftermath of flood people are more likely to take insurance policies.
• People who know someone who has been affected by flood are more likely to buy flood insurance regardless of actual flood risk.
• People are optimistic when assessing their own risks.
• People intuitively make plans in a short-time scale when making decisions about cost and benefits. This effect is stronger the more immediate the benefit.
• The way risk is presented has an impact on the decision. Return periods lead to a lower risk perception.
• The usual framing of insurance may discourage take-up because it comprises a short-term loss traded for an uncertain longer-term gain from coverage.
• The gain from flood prevention and resilience measures is uncertain, whereas the cost is clear.
• People avoid the decision of purchasing flood insurance because this action contradicts three key emotions: (i) living in a secure home, (ii) nature is benevolent, and (iii) the state can protect people.
• Social stigma could play a role in people not taking up flood protection measures if no one else in the community has done so.
• People are unsure on how to choose flood resistance and resilience measures. There is a lack of trust in the product. These two factors indicate unnecessary complexity in the decision-making process.
• Communication could have a strong role to play in supporting the take-up of property flood resilience measures.
• Communication of risk, cost, possible actions, and the need for action could have a significant impact on the likelihood of consumer action.

Overall this highlights the need for a significant programme of research and statistical evaluation; both to explore the Augmented PMT that we suggest and, more specifically, how attempts can be made within this framework, to increase the likelihood that households at risk of flooding will install property level flood resistance and resilience measures. This research agenda would cover a range of issues including:

- Whether targeted approaches can increase ownership of the need for households to take action, either in isolation or in combination with initiatives to increase understanding of a property-specific risk of flooding. For example, by simultaneously attempting to shift social norms to place the onus of action on the householder;
- What balance flood risk communications should take in attempting to increase threat perception through information, without having negative impacts on coping and/or threat appraisal; and
- Whether helping consumers to understand the options for resistance and resilience measures that are available ought to be a priority, or whether this only adds to complexity and reduces the likelihood of action.

Each of these, and others, represents a significant research agenda, which will need to include a range of flood risk management, communications, and behavioral science professionals.

5. Conclusions

The work reported here has put forward an Augmented PMT based on understanding both consumer's Ownership Appraisal and the behavioral biases that can impact on each of the Threat and Coping Appraisal, as well as Ownership Appraisal within the Augmented PMT. If this approach was adopted more widely and factored into policy development, as policymakers seek to influence householders' decisions and their likelihood to take positive actions to reduce their individual flood risk, this could have a significant impact on policy and practice towards individual property level flood resistance and resilience measures and the likelihood of their uptake. While the focus of our work has been on flooding in the UK, there is the potential for our proposed extension to PMT to be applied to other countries and to other hazards where households/consumers have a choice over whether they take action to protect themselves or their properties.

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